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SOUTHERN CALIFORNIA REGIONAL ITS ARCHITECTURE

Phase 2.1 – Development of Orange County Regional ITS Architecture

FINAL DRAFT Version 5.0

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DISCLAIMER

The contents of this report reflect the views of the author who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of SCAG or U.S. DOT. This report does not constitute a standard, specification or regulation.

CONTRACT INFORMATION

This document is produced as the deliverable for Phase 1 of a series of documents divided into four phases that collectively represent the Southern California ITS Regional Architecture. The value of the contract, Agreement No. 07A1670, is as follows:

Table 1 - Contract and Sub-Contracts

Prime-NET	$315,674
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REVISION TABLE

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1 INTRODUCTION

1.1 Project Purpose and Background

A regional Intelligent Transportation System (ITS) architecture is an organized view of the world of transportation technology that is intended to help maximize the benefit of individual investments. That is, it tries to capitalize on years of previous investment in transportation technology by identifying the interfaces and paths that will make it possible to integrate many systems in the future. Sharing information in this way multiplies the value of the original investment many times over.

The Orange County Regional ITS Architecture provides a framework that includes a vision for the future deployment of ITS applications in the County. The Regional ITS Architecture incorporates the existing and planned ITS projects, and it effectively provides a path to be followed as new projects are conceived, designed and deployed. The Orange County Regional ITS Architecture is a document but it should also be viewed as a process that will be maintained, revised, and validated as needed over the years. A coordinated effort amongst the involved Stakeholders will promote the continuation of this effort and thus realize the value of integrated ITS projects in the future. This Orange County Regional Architecture encompasses freeway, toll-road and arterial traffic management, transit management, security and emergency services management, traveler information and airport landside traffic management.

Orange County represents a considerable level of maturity with regard to ITS deployments and also has a history of well conceived ITS plans. The original Master Plan for Intelligent Vehicle/Highway Systems was begun in 1992 and completed in 1993. It was then updated in 1998 and at this stage greater recognition was given to transit. The plan was consistent with the then current version of the National Architecture. It included a planned progression for system development which recognized all of the existing legacy systems and looked forward to the expansion of a hybrid communication system for data exchange using leased lines and eventually culminating in a fiber-based wide area network that could be accessed and used by an ever increasing number of agencies over time. Outreach for the plans was extensive and included all cities, the regional and many neighboring agencies as well as the private sector which included event centers, shopping malls, major employers, Transportation Management Associations and the media. The chief champion of the plan was the Orange County Transportation Authority (OCTA) with support from Caltrans, many of the Orange County cities and the County.

In recent years OCTA's priorities and plans have shifted. The agency has given priority to launching many other very significant projects, particularly focusing on badly needed freeway improvements, the purchase of the SR-91 Express Lanes. Meanwhile the Orange County cities have continued to upgrade and improve their systems and Caltrans District 12 Traffic Management Center (TMC) has moved to a new purpose-built facility, which also co-locates the California Highway Patrol (CHP) dispatch and the

County TMC. A new group has been established that meets regularly at the District 12 TMC to discuss improved coordination between the cities and Caltrans and seek more funding opportunities for a variety of ITS related projects. This group forms the core of the new Stakeholder group.

The purpose of this document is to describe the revised system architecture on which future ITS projects in Orange County will be based and to update the system inventory, Stakeholder lists, sequence of projects and to agree on continuous plan for future architecture maintenance.

In addition, as a requirement of the Transportation Equity Act for the 21st Century (TEA-21) the FHWA/FTA Rule/Policy now implements 5206(e), which requires that all ITS projects funded from the Highway Trust Fund (including transit projects funded from the Mass Transit Account) be in conformance with the National ITS Architecture and appropriate standards.

The document is organized into the following sections:

1. Introduction
2. Regional Description
3. Regional Stakeholders
4. ITS Inventory
5. User Needs and Services
6. Operational Concepts
7. Functional Requirements
8. Interconnects and Architecture Flow
9. Project Sequencing
10. Identification of Required Standards
11. Architecture Maintenance
12. List of Agreements

Appendices:

- Acronyms and Terms
- Inventory Report
- Stakeholder Report
- Examples of Interagency Agreements
- Additional Standards Information
- ITS Interconnect
- ITS Data Flows
- Stakeholder Contact List
- Meetings Minutes

- Stakeholders Comments Disposition
- Railroad Crossings

The above contents are consistent with the requirements of the Rule/Policy and therefore satisfy the federal requirements for documentation. To aid in the interpretation of the requirements the document follows guidance contained in U.S. DOT publication "Regional ITS Architecture Guidelines – Developing, Using and Maintaining an ITS Architecture for Your Region" prepared by the National ITS Architecture team October 12, 2001. The Orange County Regional ITS Architecture uses the current National ITS Architecture Version 5.0 and the latest version of the software tool TurboArchitecture™version 3.0.

1.2 Project Time Frame

The regional ITS architecture should look far enough into the future in order to guide the efficient integration of services over time. The Orange County Regional ITS Architecture planning horizon is ten years. This time horizon was selected in recognition that it takes time to make serious progress even in already developed and sophisticated counties. A longer time period was not deemed appropriate as it is expected that much progress will be made within that ten-year period.

1.3 The Southern California Regional ITS Architecture

The FHWA/FTA Rule/Policy specifies that there should be a Regional ITS Architecture for the region that is no less than the boundaries of the metropolitan planning area. The Southern California Association of Governments (SCAG) is the Metropolitan Planning Organization (MPO) for six counties in California. By virtue of its MPO status SCAG has assumed responsibility for building consensus around the Southern California Regional ITS Architecture. This is composed of five county level architecture documents, which represent local stakeholder needs and interests and a separate document that deals with multi county issues of importance to the Southern California Region. The Orange County Regional ITS Architecture is one of the five regional county level architectures, which are as follows:

- Imperial County Regional ITS Architecture
- Inland Empire (i.e. San Bernardino & Riverside Counties) regional ITS Architecture
- Los Angeles County Regional ITS Architecture
- Orange County regional ITS Architecture
- Ventura County Regional ITS Architecture

2 REGIONAL DESCRIPTION

This section describes the general demographic, geographic and transportation system characteristics of Orange County. It is within this context that the Orange County Regional ITS Architecture is developed. The County map in Figure 2-1 shows the major highways and boundaries with the adjacent counties.

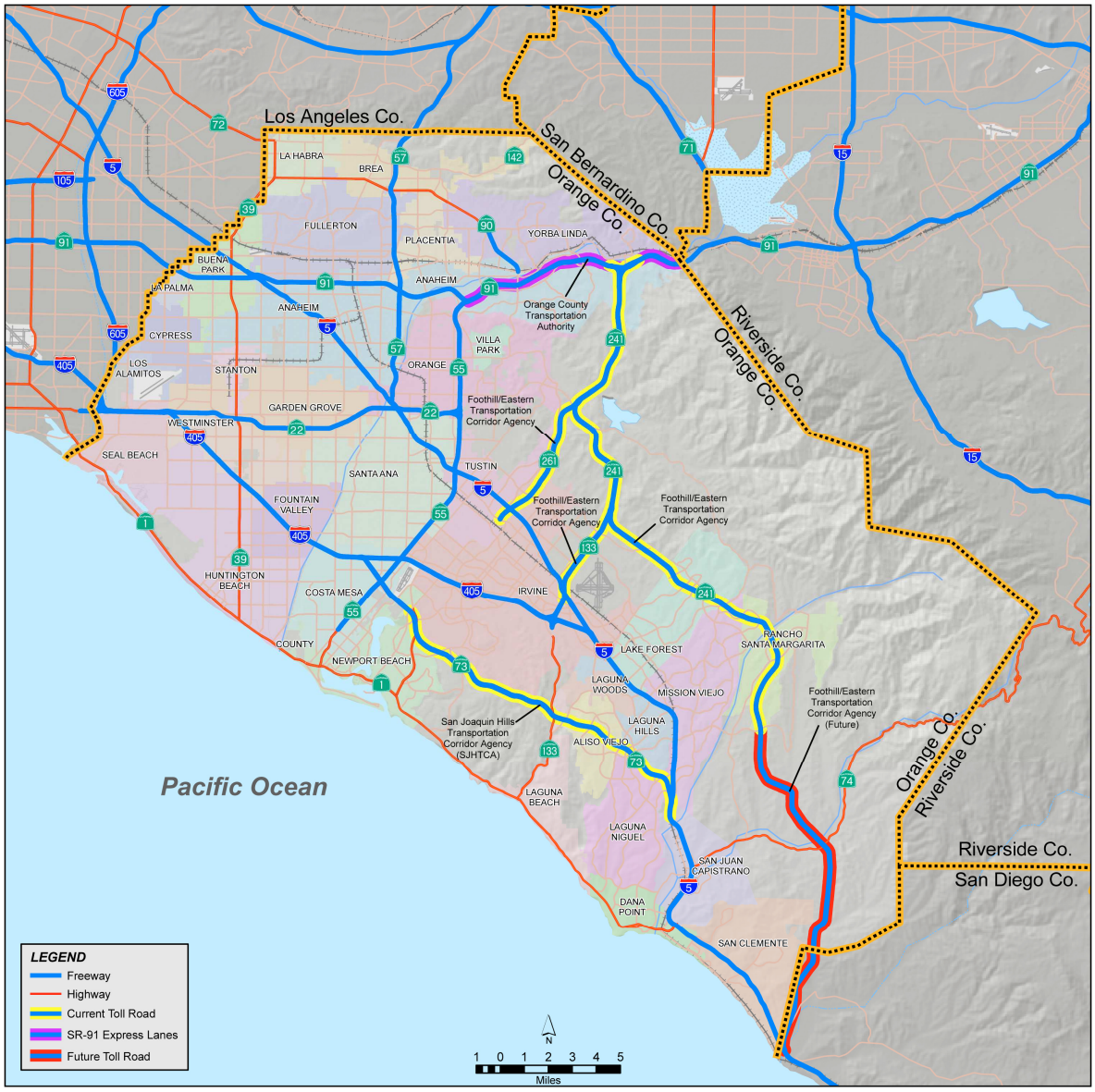

Figure 2-1: Orange County Map

Orange County has a population of 2,978,800, which is the 5th largest County by population in the United States, and second largest County by population in California, behind Los Angeles County. The County's geographic area is 798 square miles, and it

is bordered on the south by San Diego County and Imperial County, on the north by Los Angeles County, on the east by Riverside County, and on the west by the Pacific Ocean. The entire Pacific coastline is 42 miles long. There are 34 cities within the County, and the two largest population centers are Anaheim and Santa Ana. The County has two airports, namely John Wayne and Fullerton Municipal. Orange County has a highly developed tourist industry. Its most famous attraction is Disneyland, which is the largest employer in the County. In addition, the County also has multiple sporting venues, recreational facilities and major shopping attractions. Orange County Visitor & Convention Bureau has pooled their resources to create the 1,100-acre Anaheim Resort, where Disneyland, Disney's California Adventure, Anaheim Convention Center, and the convention hotels are enveloped by the gardens of the new resort environment. These large attractions are not adjacent to any major airport but are connected to LAX, John Wayne and Ontario airports by already heavily loaded highways. There are 91,220 jobs in the County and the annual travel volume is an estimated 25.5 million person-trips. In 2003, the median family income in the County was about $73,000 while the national average for the same period is $56,500 (U. S. Department of Housing and Urban Development), and the $127 billion Gross County Product counts for 1.2% of the U.S. GNP.

2.1 Transportation Systems

Caltrans District 12 operates and manages the freeway system in Orange County. Seventeen state freeways and highways crisscross the District boundaries. The total length of these highways is over 300 miles. In addition, there are 240.9 lane-miles of HOV or carpool lanes operated in the District in 2004.

In addition to Caltrans, Orange County Transportation Authority (OCTA) is the County's primary transportation agency. Its major service programs include buses and paratransit, which operate throughout the County. OCTA is also the owner of the SR-91 Express Lanes, a toll facility operating in the center median of SR-91. Orange County is also one of the five counties that financially support MetroLink commuter rail services. Measure M, approved in 1990, is Orange County's 0.5% sales tax for transportation. It has been providing significant funding for improvements of the freeway, local streets, and transit systems. Measure M is due for a vote on its renewal in 2009.

2.1.1 Major Roadways

Table 2-1 introduces the most important freeways in Orange County. These freeways are equipped with Vehicle Detection Stations (VDS), Closed-Circuit Television (CCTV) cameras, Changeable Message Signs (CMS), Ramp Meters Stations (RMS) at entrance ramps, and Highway Advisory Radio (HAR). These ITS field elements are connected to the Caltrans District 12 TMC located in Irvine.

In addition to the freeways, Orange County is home to a number of toll roads. The Transportation Corridor Agencies (TCA) was formed in 1986 to plan, finance and

construct a 67-mile public toll road system. The San Joaquin Hills Transportation Agency manages the 15-mile SR-73 Toll Road. Officials from 14 cities and County Supervisorial Districts near the SR-73 Toll Road are appointed to serve on the Agency's Board of Directors. The Foothill/Eastern Transportation Corridor Agency manages the 241, 261 and 133 Toll Roads which link the Riverside SR-91 Freeway near the Orange/Riverside County border to the I-5 in Irvine and to communities in South Orange County. Officials from 15 cities and County Supervisorial Districts near the SR-241, SR-261, and SR-133 are appointed to serve on The Agency's Board of Directors. The fee-title to both toll roads belongs to Caltrans, which maintains the highways. The Toll Road Agencies operate and maintain the necessary tolling equipment. On retirement of the debt the roadways are planned to be made toll-free. Toll rates for the TCA are set by the Boards of Directors and congestion pricing has been implemented in some locations.

The final toll road is the SR-91 Express Lanes, which are located in the center median of the 91 Freeway. They have recently been purchased by OCTA and are operated under a contract with a private toll road operator. The toll lanes operate on the basis of tolls set for optimizing traffic flow at free flow speeds. This requires continuous monitoring of the toll lanes and rates are adjusted accordingly although not currently in real time.

Table 2-1: Caltrans District 12 Major Roadways

Roadway	Alternative Name	Brief Description
I-5	Santa Ana Freeway	County's "Main Street". Major improvements since 1990 have cost Measure M $1.5 billion. I-5 Far North project is anticipated to be under construction in 2006.
I-405	San Diego Freeway	Facing serious congestion problems, I-405 carries over 300,000 vehicles/day in some sections, and the volumes are expected to increase 25 percent by 2025. The I-405/SR-55 interchange is one of the top 10 busiest in the nation. The I-405/SR-73 interchange has a 3-year, $80 million construction improvement project.
SR-22	Garden Grove Freeway	This 12-mile freeway intersects most of the major north/south corridors in Orange County - making it a vital link. Currently it carries more than 200,000 cars daily. A major improvement project has just begun.

Roadway	Alternative Name	Brief Description
SR-55	Costa Mesa Freeway	Under constant widening and enhancement since 1962, now the freeway has a total of five lanes in each direction including the carpool lane, serving traffic flow to more than 200,000 motorists each day.
SR-57	Orange Freeway	A section of HOV and some auxiliary lanes were added in 1992 as the first Measure M project. Northbound spot capacity enhancement and addition of a section of truck climbing lane are under study.
SR-91	Riverside Freeway	Includes the 91-Express Lanes in the median owned by OCTA.
SR-73	San Joaquin Hills Toll Road	San Joaquin Hills TCA Toll Road.
SR-133 (part)	Foothill Eastern Toll Road	Foothill Eastern TCA Toll Road.
SR-241		
SR-261		

In addition to its freeway system, the Smart Corridor/Street system was adopted specifically to improve regional mobility, interoperability and interagency communications/signal coordination via expanded ITS ATMS/ATIS enhanced measures along the County's freeways and parallel and most predominate surface streets. The Smart Street concept seeks to improve roadway traffic capacity and smooth traffic flow through measures such as traffic signal synchronization, bus turnouts, intersection improvements and addition of travel lanes by removing on-street parking and consolidating driveways.

The network is comprised of the 21 streets listed below covering approximately 22 miles of arterial roadway. Beach Boulevard was the first Smart Street project to be implemented. Three additional Smart Streets are in various stages of implementation by partner cities. These include Imperial Highway, Katella Avenue and Moulton Parkway (also known as Edinger Avenue, Irvine Center Drive and Street of the Golden Lantern.

1. Adams Avenue -- Beach Boulevard (SR-39) to Harbor Boulevard
2. Beach Boulevard (SR-39) -- Pacific Coast Highway (SR-1) to Imperial Highway (SR-90)
3. Bolsa Avenue/First Street -- Bolsa Chica Road to Santa Ana Freeway (I-5)

4. Bolsa Chica Road -- Warner Avenue to San Diego (I-405)/Garden Grove (SR-22) Freeways
5. Crown Valley Parkway -- Pacific Coast Highway (SR-1) to Foothill Transportation Corridor (SR-241)
6. El Toro Road -- Laguna Canyon Road (SR-133) to Foothill Transportation Corridor (SR-241)
7. Harbor Boulevard -- Imperial Highway (SR-90) to Costa Mesa Freeway (SR-55) extended
8. Imperial Highway (SR-90) -- Beach Boulevard (SR-39) to Santa Ana Canyon Road
9. Irvine Boulevard -- Costa Mesa Freeway (SR-55) to El Toro Road
10. Jamboree Road -- Irvine Boulevard to Corona Del Mar Freeway (SR-73)
11. Katella Avenue -- San Gabriel River Freeway (I-605) to Costa Mesa Freeway (SR-55)
12. Laguna Canyon -- Laguna Freeway (SR-133) to Imperial Highway (SR-90)
13. MacArthur Boulevard -- Pacific Coast Highway (SR-1) to San Joaquin Hills Corridor (SR-73)
14. Moulton Parkway -- (Edinger Avenue/Irvine Center Drive/Moulton Parkway/ Street of the Golden Lantern) Main Street in Santa Ana to Pacific Coast Highway (SR-1)
15. Newport Boulevard -- Pacific Coast Highway (SR-1) to Industrial Way (southern terminus of Costa Mesa Freeway (SR-55))
16. Orangethorpe Avenue -- Beach Boulevard (SR-39) to Imperial Highway (SR-39)
17. Pacific Coast Highway -- Warner Avenue to Freeway Terminus in Dana Point (near Street of the Golden Lantern)
18. State College Boulevard -- Riverside Freeway (SR-91) to Imperial Highway (SR-90)
19. Tustin Avenue/Rose Drive -- Riverside Freeway (SR-91) to Imperial Highway (SR-90)
20. Valley View Street -- Garden Grove Freeway (SR-22) to Riverside Freeway (SR-91)
21. Warner Avenue -- Pacific Coast Highway (SR-1) to Harbor Boulevard

2.1.2 HOV System

Orange County's High Occupancy Vehicle (HOV) system is the most heavily used of all those in the State of California and it is also the most extensive HOV lane system in the United States. The Orange County HOV system encompasses 240.9 directional lane-miles over a span of five different freeways. In addition, this network includes direct HOV to HOV connector ramps at the following eight directional interchanges: I-5/I-405,

I-5/SR-55, I-5/SR-57, and SR-91/I-5. These direct connectors allow carpool lane passengers direct connection from one freeway to another without having to re-enter the general freeway lanes. Design is underway to construct a direct HOV connector for the I-405/SR-55 interchange by 2004/2005. Also, the expansion of SR-22 will add an HOV lane in each direction. The SR-22 is currently the only freeway in Orange County without HOV lanes.

A study conducted by the OCTA in collaboration with the CHP, Caltrans, and Parsons Brinkerhoff, compared the Orange County HOV system with that of other carpool lane networks throughout California. It concluded that Orange County's system carries more vehicles per hour during rush hour periods than any other HOV system in California. The lanes handle an average of 1,568 vehicles per hour, as compared with Los Angeles's 1,013 vehicles per hour and 930 vehicles per hour in the San Francisco Bay Area. Carpool lanes often operate at near-capacity levels throughout the entire day.

2.2 The Mobility Challenge between Orange County and Riverside County

Each day, more than a quarter million vehicles travel between Riverside and Orange County. Only two choices of roadways are available: SR-91 in the north and the narrow two-lane Ortega Highway in the south. Consequently, SR-91 is one of the most congested freeways in Southern California. Everyday, thousands of Riverside and Orange County residents experience commute times of up to 3 hours to get to work and return home. In addition, the forecasted number of daily trips over the next 20 years is expected to double to nearly half a million.

The OCTA and the RCTC have teamed up to assess multi-modal alternatives for improving travel between Orange County and Riverside County. The team has accomplished the following improvements since 2002.

- MetroLink was expanded in the Inland Empire connecting the Orange County line and the Los Angeles County line
- OCTA purchased the SR-91 Express Lanes, which removed the restrictions to future expansion of the SR-91
- New pavement is already in place with a new westbound auxiliary lane providing congestion relief and improved speeds
- A re-striping project extended the westbound auxiliary lane
- OCTA authorized the use of $2.5 million in SR-91 Express Lanes toll revenues for an eastbound auxiliary lane extension
- OCTA is completing four Project Study Reports identifying specific transportation issues and potential solutions, conceptual engineering and cost estimates
- Caltrans and RCTC are completing five project studies for improvements on the SR-91 between the Riverside County line and the I-15. This would include improvements to the I-15 Interchange

- Caltrans is currently widening SR-71 just north of the SR-91, which will add another lane in each direction to SR-71 and provide relief to commute on SR-91
- OCTA and RCTC have initiated a $3.3 million 18-month Major Investment Study (MIS) with the Transportation Corridor Agency (TCA) to evaluate proposed, long-term solutions to mitigate traffic congestion within the SR-91 corridor and plan for future growth

2.3 Transit

Orange County provides extensive bus and rail transit services. Fixed route bus service includes 6,500 bus stops and 76 bus routes. User request services include ACCESS and Senior Mobility Program (SMP). ACCESS is the OCTA's shared-ride service for people meeting the Americans with Disabilities Act (ADA) eligibility criteria. The SMP is designed to fill the gap between local fixed route buses and ACCESS service by providing local transportation services to seniors in participating cities. Greyhound is an alternative long distance bus service available in Orange County.

In addition to buses, the OCTA supported MetroLink, which has ten commuter rail stations in Orange County as shown in Figure 2-3. The OCTA offers free destination connecting bus service (StationLink) from seven of the MetroLink stations. AMTRAK also provide services in the County.

2.4 Railroad Crossing

Orange County is crisscrossed with rail lines, most of which are at grade crossings. Railroad crossings pose safety problems and cause delays to arterial traffic but are also essential for the movement of goods and passengers throughout the County. Grade separation of rail and arterial routes is usually prohibitively expensive. ITS solutions to help improve safety and traffic flow are therefore likely to be of increased importance in the future. Figure 2-2 illustrates the amount and distribution of Orange County railroad crossings. In the map, red flags mark those grade crossings with high train frequency and high traffic volumes. Each red flag is labeled with a PUC Crossing Number that can be referenced in Appendix L for more detailed information Bright green flags mark other grade crossings and dark green flags mark grade separated crossings. Figure 2-3 illustrates the rail lines and train stations including both Amtrak and MetroLink in Orange County.

Figure 2-2: Orange County Railroad Crossings

Figure 2-3: Orange County Train Stations

2.5 Airport

John Wayne Airport is the only commercial service airport in Orange County. It is owned and operated by the County of Orange. In 2003, the airport served 8.5 million passengers and 15,406 tons of air cargo. There are 7,662 parking spaces available around the airport.

2.6 Emergency Management Services

This section provides a high-level description of the Emergency Management Services (EMS) within Orange County. This includes agencies responsible for law enforcement, incidents response, and fire and rescue services.

2.6.1 California Highway Patrol

The California Highway Patrol (CHP) provides legal enforcement, traffic patrols, and response to incidents and emergencies on California highways. Their area of jurisdiction is all freeways, all state routes, and some roadways in County's unincorporated areas. They are also contracted to provide service on the SR-91 Express Lanes.

The CHP is co-located with the Caltrans District 12 TMC in Irvine. This collocation of dispatch services is a valuable means of fostering close cooperation between the two agencies. In addition, the Emergency Operations Center (EOC) at the same location is shared by both agencies. CHP staff members take 911 calls and gather other information from the TMC such as CCTV images, status reports, traffic flow data, and weather data and disseminate information to the field staff. The field staff includes CHP officers, allied agencies such as local police or public works, and private firms with contracts to clean up hazardous material spills.

2.6.2 County Sheriffs and Fire Departments

Orange County has a Sheriff Department (OCSD) and Fire Authority (OCFA) that provide law enforcement, fire protection, and EMS services in unincorporated areas of the County, as well as to certain City jurisdictions under contract arrangements. The OCSD together with OCFA provides fire and security services to both John Wayne Airport and OCTA transit services. These departments are dispatched through County 911 centers. These centers are equipped with Computer Aided Dispatch (CAD) systems, which allow dispatchers to initiate emergency response through radio dispatch communications and then track response activities performed by field personnel.

Orange County has a highly coordinated emergency management network managed by the Sheriff's Department. "Control One," as it is called, is based on an 800 MHz radio communication system. The users jointly funded the system and each user agency is responsible for the cost of operating and maintaining their elements of the system. The system is used by over 100 Orange County agencies for emergency communication and coordination purposes. These agencies include County Sheriff, city Police Departments, County Fire Authorities, RDMD, John Wayne Airport, Animal Control, County Lifeguard, and city public works departments. The entire system contains about

15,000 radios used on a daily basis. Interoperability is assured through common channels. There are projects underway to support interoperability with non-Orange County agencies especially law enforcement. The heart of Control One is located at the Loma Ridge Emergency Management facility, which also houses the Emergency Operations Center for Orange County.

The Control One system uses voice communication for the purposes of coordinating and managing services. There is no real time data exchange between the Computer Aided Dispatch Systems (CADs) of different agencies. Control One is not connected to State and Federal level emergency services, including CHP dispatch, State Lifeguard, and other national security agencies. However, Control One has an effective direct connection to CHP and Caltrans through a dedicated landline.

2.6.3 City EMS Agencies

Many of the larger cities have their own police and/or fire departments, which handle law enforcement, fire protection, and EMS for their jurisdictions.

2.7 UCI Advanced Testbed Research Program

UCI Testbed is a state and federally supported effort that is headquartered at the University of California, Irvine (UCI). The program is developing and evaluating new technologies for traffic system monitoring and control. The ITS Advanced Transportation Management System (ATMS) laboratories are included in this overview because they are potentially a significant regional resource. They include workstations tied directly to the City of Irvine TMC, the Irvine Traffic Research and Control Center (ITRAC), the City of Anaheim, and to the Caltrans District 12 TMC.

2.8 Orange County Cities

There are 34 cities in Orange County. Their population, size, and the level of advanced transportation information technology application are widely diversified. Table 2-2 provides a brief description to each City in alphabetic order.

Table 2-2 Orange County Cities Description

City Name	City Population	City Size (Square Miles)	City ITS Elements & Systems
Aliso Viejo	48,000	6.9	Forty-three signalized intersections maintained by a contractor. Short-term plans for signal controller replacement.

City Name	City Population	City Size (Square Miles)	City ITS Elements & Systems
Anaheim	328,014	50.37	Long history of deployment & use of ITS for traffic and event management. TMC manages 280 signalized intersections, cameras and CMS. Plans for renovation of TMC and update and add field elements such as cameras.
Brea	36,857	11.1	A total of 48 city-controlled and 24 Caltrans controlled traffic signals in the City. Two State Highways, SR-90 and SR-142 traverse the city. City uses a Multisonics VMS-330 system to control and monitor the signal system. Short-term plans to upgrade the signal system and improve coordination.
Buena Park	80,600	10.29	Seventy-two City controlled traffic signals, 21 shared with neighbors and 26 Caltrans controlled (SR-39 and I-5/SR-91 interchanges). Upgrade plans include use of fiber, new central signal control system with traffic responsive signal timing, CCTV, video detection and DMS. Also upgrading signal pre-emption to Priority Sensitive Opticom units for emergency services.
Costa Mesa	103,823	16	City has 140 signalized intersections and 25 Caltrans controlled intersections (I-405, SR-55 and SR-73) traverse the City. Current upgrade plans include integration of the VMS 330 signal system with the BiTrans QuicNet 4 monitoring system for Caltrans signals into one graphical user interface, integration with City of Santa Ana signal system, expansion of the CCTV system, expanded fiber communications and joint agency signal coordination operations.

City Name	City Population	City Size (Square Miles)	City ITS Elements & Systems
Cypress	46,500	6.6	City has 47 traffic signals and a few CCTV cameras that it monitors from its TOC.
Dana Point	35,110	6.5	City has 21 signalized intersections and will add 15 more in the coming year. Signal upgrades are planned and will include emergency preemption and back-up battery systems on all signals.
Fountain Valley	55,171	9.87	City has 49 traffic signals, 46 controlled by City and 3 by other agencies. Currently upgrading systems with CCTV cameras, 2070 controllers, expansion of fiber optic communications and improved TMC. Citywide and multi-jurisdictional signal coordination involves coordination with six agencies, including Caltrans.
Fullerton	134,187	22.3	City controls 144 traffic signals and Caltrans controls 25 traffic signals on State Highways and at SR-91 and SR-57 freeway interchanges. City signal and communications systems are being extensively upgraded. Coordination of signals with other agencies is reflected in several multi-jurisdictional projects.
Garden Grove	170,000	17.8	A total of 110 City controlled traffic signals and 15 Caltrans controlled signals on State Highway (SR-39) and freeway interchanges. SR-22 freeway traverses the city. TMC shares CCTV images with Police Department for surveillance and safety purposes. Plans include use of DMS and HAR to relay traffic information to the public, signal timing for re-routing of congestion and incident caused traffic problems and emergency response facilitation.

City Name	City Population	City Size (Square Miles)	City ITS Elements & Systems
Huntington Beach	195,000	28	City controls 125 signals and several more signals are located on Caltrans controlled (SR-39 and SR-1) highways. Systems integration with neighboring cities is central in several projects. Future projects include fiber optic communication systems, DMS and CCTV cameras, and signal coordination.
Irvine	171,700	55	City controls 300 signalized intersections from the Irvine traffic Research and Control Center (ITRAC). Two freeways, I-5 & I-405 and 3 toll roads traverse the city. The city is moving from proprietary signal control systems to open architecture and use of 2070 controllers. About 80 CCTV cameras relay images to the ITRAC center and 5 DMS can be used for incident management. Camera feed is available to the public via the city web site. The ITRAC systems are connected to both Caltrans District 12 and UCI via a fiber optics backbone. A future priority will be emergency vehicle signal preemption.
La Habra	55,000	7.3	City controls 33 traffic signals. The majority use 2070 controllers and are interconnected. A total of 32 Caltrans controlled traffic signals are located on State Highways (SR-39, SR-72 & SR-90). Future plans for City are for fiber optic communication system and CCTV on major arterials, and inter-tie with Caltrans District 12 and neighboring cities.
La Palma	15,408	2.0	The few signals are interconnected to the adjoining cities of Buena park, Cypress and Cerritos.

City Name	City Population	City Size (Square Miles)	City ITS Elements & Systems
Laguna Beach	24,000	8.8	The city is traversed by two major State Routes, PCH and SR-133 Laguna Canyon Road. All of the associated signals are operated and maintained by Caltrans.
Laguna Hills	33,000	6.6	City controls 47 traffic signals, which are being gradually updated.
Laguna Niguel	63,000	14.7	Has a signal system maintained and operated by contractors. The system is being upgraded incrementally.
Laguna Woods	18,300	4	The city has an older signal system with current plans for upgrades in this year.
Lake Forest	76,000	12.5	City controls 73 traffic signals with fully actuated type NEMA 90 controllers. Plans to upgrade all controllers and enhance synchronization in the future.
Los Alamitos	12,500	4.01	City has 23 traffic signals with plans for upgrading and synchronization.
Mission Viejo	96,000	18.7	City owns and operates 110 traffic signals operated by a central system. Also City has 6 CCTV cameras (4 in Caltrans ROW to be relinquished to Caltrans shortly with shared rights of use). A current project will provide fiber inter-tie with Caltrans for exchange of data and video.
Newport Beach	70,032	17.78	City owns and operates 109 traffic signals while Caltrans operates additional signals on PCH. City has centralized signal control, vehicle detection and adaptive signal control.

City Name	City Population	City Size (Square Miles)	City ITS Elements & Systems
Orange	128,821	23.39	City has 148 traffic signals, 108 signals are controlled by City and 40 remaining signals by other agencies. The City is traversed by SR-22, SR-57 and SR-55 freeways. Recently installed camera network brings images to the TMC. Future plans include expansion of fiber optic system and for communication links with Santa Ana and Anaheim TMCs.
Placentia	46,488	6.59	A total of 47 City controlled and 3 Caltrans controlled traffic signals in the City. All but one, City controlled traffic signals are interconnected and are monitored from the TMC. A major Rail Crossing Safety Improvement project is underway which includes 4-quadrant gates, upgraded traffic signals, installation of pre-signals to prevent queuing across the railroad tracks and other safety measures at several crossings in the City.
Rancho Santa Margarita	50,000	12.27	City has 50 signalized intersections. Future plans include video monitoring and improved coordination with Caltrans ramp signals.3 principal arterials are operating under computer supervised coordination
San Clemente	49,936	17.62	The City has 50 traffic signals and Caltrans operates an additional 8. Majority of signals include emergency pre-emption system. Some intersections have local master controller for coordination with adjacent signalized intersections.

City Name	City Population	City Size (Square Miles)	City ITS Elements & Systems
San Juan Capistrano	35,000	14.2	The City has 34 traffic signals. Signal system upgrades are planned including a real-time adaptive signal system. Emergency vehicle signal preemption is deployed.
Santa Ana	338,000	27.14	The City controls a total of 276 traffic signals (including 3 that are in Fountain Valley), shares another 33 traffic signals that are operated by neighboring agencies. Out of the 306 traffic signals, 24 of them are located on Caltrans controlled highways. City is traversed by SR-22, I-5, I-405, SR-57 and SR-55. In the past, the City's TMC has exchanged data with Irvine and Caltrans and would like to re-establish the links and add additional links with neighboring agencies for congestion and incident management. Embarking on signal system upgrade project that includes adaptive traffic signal control.
Seal Beach	24,900	13	I-405 bisects the city. Signal system upgrades are underway which will also enable signal interconnects and coordination.
Stanton	38,000	3.1	The City has 21 traffic signals operated and maintained under contract. There are no current plans for system upgrades.
Tustin	67,504	11.4	City has 98 intersections. Future plans may include video monitoring and improved coordination with freeway ramp signals.

City Name	City Population	City Size (Square Miles)	City ITS Elements & Systems
Villa Park	6,100	2.1	City has 4 isolated traffic signals owned and operated by the City. There are no current plans for upgrades.
Westminster	90,000	10.11	A total of 65 City controlled traffic signals, 14 Caltrans controlled signals and 10 signals shared with other agencies. The City TMC will have a fiber optic communication link with Westminster Police Department, which allows the Police Department to utilize the installed CCTV for safety and security purposes. SR-22 and I-405 freeways traverse the city. Westminster coordinates with Caltrans and other agencies for emergency management operations. TMC objectives are: signal timing for re-routing of congestion, traffic accident and emergency response facilitation. Future projects are central traffic signal control system replacement, video detection, CCTV surveillance, upgraded signal system and more sophisticated coordination with adjacent cities and Caltrans.
Yorba Linda	58,918	19.37	City has 47 signalized intersections. Future plans include video monitoring and improved coordination with Caltrans ramp control signals.

2.9 Institutional Complexity of Orange County

The institutional complexity involved in building an ITS architecture and consensus within Orange County is enormous due to the number of transportation-related agencies in this area and their complicated authority delineation. This chapter has introduced the public agencies that participate in the planning, implementation, operation, management, and maintenance of the large transportation network system in Orange County. These agencies and their brief descriptions are summarized in Table 2-3

Table 2-3: Transportation Agencies in Orange County

Agency	Responsibility and Authority
SCAG	SCAG prepares and updates the regional transportation planning documents including the Regional Transportation Plan (RTP) and Regional Transportation Improvement Plan (RTIP). Projects in receipt of state and federal funding must be included in the RTIP process.
Caltrans District 12	Caltrans District 12 is responsible for the design, construction, maintenance, and operation of the highway system in Orange County.
OCTA	OCTA is the County's primary transportation agency. It operates the transit system and plans, coordinates and provides funding for the regional transportation systems.
Orange County (RDMD)	The Resources and Development Management Department (RDMD) of Orange County is responsible for the operation and maintenance of traffic signals in the County's unincorporated areas and John Wayne Airport. In addition, RDMD provides traffic signal maintenance for several cities including Laguna Hills, Laguna Woods, and Lake Forest by contracts.
Cities:	There are 34 cities in Orange County, and their size, population, and transportation network complexity varies widely. With respect to transportation operation and maintenance, some cities are equipped with their own TMCs and operate and maintain their own signal systems. Other cities rely on the County, Caltrans or contractors for the cities' traffic management.
CHP	California Highway Patrol enforces traffic laws and regulations on the freeways in Orange County. It constantly monitors the network through data provided by Caltrans and the public, and responds quickly by dispatching emergency vehicles and field staff to take control of incidents and manage congestion.
Fire Authority	Orange County Fire Authority (OCFA) assists the CHP in clearing accidents on highways that involve fire and or explosive hazards.
SR-91 Express Lanes	After OCTA purchased the SR-91 Express Lanes, the toll facilities have been managed under contract. The lanes are maintained by Caltrans and enforced by CHP.
TCA	Except for the SR-91 Express Lane, Transportation Corridor Agencies (TCA) owns, plans, finances, constructs and operates Orange County's 67-mile public toll road system, including SR-73, SR-133, SR-241 and SR-261.

Agency	Responsibility and Authority
MetroLink	MetroLink is the major regional commuter rail system in Southern California. It includes commuter and other passenger services, linking communities to employment and activity centers. MetroLink has three lines in Orange County leading to LA County, Riverside County and San Diego County.
Amtrak	Amtrak is a primary national rail service provider. Amtrak has three routes in California, of which only the Pacific Surfliner Route passes through Orange County.
Airport	John Wayne Airport is the only commercial airport in Orange County. It is owned and operated by the County of Orange.

From this table, one can appreciate both the number and complexity of the institutions involved in the construction, operation and maintenance of the transportation system in Orange County. Funding for ITS competes with the many other requirements within the region. Measure "M," the local half-cent sales tax, is one source of funding but increasingly agencies are also looking to state and federal sources. Success in finding funding all too often requires agencies to work cooperatively and employ the help of lobbyists and a political network.

3 REGIONAL STAKEHOLDERS

The process of ITS architecture development is to a large degree a process of consensus building. The participation and agreement in principal of a diverse set of local Stakeholders, is critical to the success of Orange County's ITS architecture. In the context of this project, Stakeholders are defined as a core set of public agencies with transportation-related management, oversight and responsibility in Orange County. This project was built on an existing group of Stakeholders who are cities that interact on a regular basis with Caltrans. Table 3-1 lists the initial core Stakeholder group that were presented in the project's kick-off meeting. The complete Stakeholder contact list can be found in Appendix H.

Table 3-1: Initial Core Stakeholder Group

Name	Agency	Email
Saied Hashemi	Caltrans District 12	Saied_Hashemi@dot.ca.gov
Mort Fahrtash	Caltrans District 12	Morteza_fahrtash@dot.ca.gov
Ken Louie	City of Irvine	klouie@ci.irvine.ca.us
Omid Segal	Caltrans District 12	osegal@dot.ca.gov
David Sorge	Costa Mesa	ddsorge@ci.costa-mesa.ca.us
Alex Salazar	Fountain Valley	Alex.Salazar@fountainvalley.org
Temo Galvez	Fountain Valley	Temo.galvez@fountainvalley.org
Mike Evans	Mission Viejo	mevans@mission-viejo.com
Jose Hernandez	Caltrans District 12	Jose_Hernandez@dot.ca.gov
Amit Shrimavle	OCTA	Ashrimavel@hotmail.com
Melissa Hewitt	Kimley-Horn (representingOCTA)	Melissa.Hewitt@kimley-horn.com
James Pinheiro	Caltrans District 12	James_pinheiro@dot.ca.gov
Dowling Tsai	Santa Ana	dtsai@ci.santa-ana.ca.us
Rob Marsh	Caltrans District 12	Robert.j.marsh@dot.ca.gov

Name	Agency	Email
Henry Pham	Caltrans District 12	Henry_Pham@dot.ca.gov
Tom Mahood	City of Orange	tmahood@cityoforange.org
John Thai	City of Anaheim	jthai@anaheim.net

In addition to this core group, the participation of all local Stakeholders was critical to the development of the Orange County ITS Architecture. Inputs and involvement were specifically encouraged and requested from Stakeholders at all stages of architecture development. Many tools were used to facilitate communication and expand the Stakeholder outreach, such as:

1. **Meetings and Workshops**: Ten Stakeholder meetings and workshops have been conducted. The dates and major objectives of each meeting are given in Table 3-2. The attendee list and meeting minutes for each meeting can be found in Appendix I, which will be added at a later date.

Table 3-2: Orange County Stakeholder Meetings

Date	Purpose
9/21/2004	Project Kick-off Meeting.
9/30/2004	Meeting with Caltrans District 12 on highway system inventory, issues, plans and suggestions
10/26/2004	Monthly Stakeholder meeting. Introduction of the coming inventory survey, status building, and call for suggestion on deliverables
11/23/2004	Monthly Stakeholder meeting. Progress and status report, suggestion and feedback collection
12/07/2004	Additional Stakeholder meeting to discuss City issues
01/18/2005	Monthly Stakeholder meeting. Progress and status report full Stakeholder meeting
01/20/2005	Stakeholder meeting to discuss Emergency Management Loma Ridge Facility
02/02/2005	Follow-up on Stakeholder meeting with Director of Communications OC Sheriff's Department
02/15/2005	Stakeholder meeting – draft final
03/22/2005	Final Stakeholder meeting

2. **Project Website**: The project website greatly facilitated and expedited the communication with the Stakeholders and the documentation of their feedback. The content and function of the project website include:
   a. Project introduction, including the contact information of the project team.
   b. Project status, including every meeting's agenda, presentation, and minutes, all deliverables' draft, and ITS TurboArchitecture™ database. For easy downloading and review, most files are provided in both PDF and Microsoft Word format.
   c. Comments from Stakeholders for any specific document are sent easily to the project team and these comments are disposed. The current comments disposition is available on the website. The complete disposition will be included as in Appendix J.
   d. The website also provides links to all other elements of the Southern California Regional ITS Architecture.

3. **Stakeholder interviews**: The project team included three major subcontractors: URS Corporation., Albert Grover & Associates (AGA), and Transportation Energy Solutions, Inc. (TES), who conducted extensive interviews with Orange County Stakeholders for a completed and up-to-date ITS inventory as well as the analysis of Stakeholders' needs, vision, ideas, and planned projects. The team developed a questionnaire with about 90 questions based on the National ITS Architecture TurboArchitecture™ software package. These questions cover arterials, freeways, transit, traveler information, emergency management, and maintenance and construction. Face-to-face interviews were conducted whenever possible, and phone calls, emails, and faxes were used as follow-up and supplements. The Stakeholders agencies interviewed include:
   - Caltrans
   - CHP
   - OCTA
   - The 34 cities
   - Transportation Corridor Agencies (TCA)
   - Orange County Fire Authority
   - John Wayne Airport
   - MetroLink and Amtrak
   - SR-91 Express Lane
   - Orange County Sheriff's Department – Communications
   - Orange County Resources and Development Management Department

4 ITS INVENTORY

In building an ITS architecture, it is important to identify the system's owners and operators, the presence of operational centers, and the communication links and data flows between various system elements and to other systems. These elements are identified and documented in the ITS inventory. The inventory is generally a list of ITS elements, and other non-ITS elements that interface with them. An elements is defined as the name used by Stakeholders to describe an ITS system or piece of a system. This chapter will identify the ITS systems in Orange County and their related elements, both existing and planned.

The methodology used to compile an ITS inventory for the Orange County consisted of distributing survey questionnaires, exchanging phone calls and emails, conducting meetings and workshops, and reviewing documents that provide additional information concerning existing ITS elements in the County. After the complete data collection, the Orange County ITS system was organized and presented in two parts, namely County level and City level. The County level inventory includes all systems whose Stakeholders are County level agencies, such as Caltrans District 12 and OCTA. The City level inventory includes systems owned by the cities.

As indicated in the regional description, Orange County is highly urbanized and advanced in its transportation technology. Therefore, the County level agencies are equipped with sophisticated and comprehensive ITS systems for freeway and toll road operations. To a somewhat lesser extent advanced systems have been deployed for arterial, emergency management, and transit systems. The ITS capabilities of the cities vary through the County depending on their size and needs. Small cities usually rely on the County for traffic operations and maintenance while larger cities with considerable ITS investment in place are now actively seeking opportunities for inter-city system integration.

4.1 County Level Systems

County level systems are summarized below:

Caltrans District 12 (CT D12)

- **Center** -- Caltrans District 12 Transportation Management Center (TMC) is located in 6681 Marine Way, Irvine, 92618. Controls, monitors and maintains all freeway and their field devices in Orange County
- **Roadside Equipment** – VDS (mostly loop detector), CCTV, CMS, HAR, RMS are all connected to the center
- **Traveler Information** – Caltrans currently uses Web and cable-TV and plans to add In-Vehicle Signing, Email, and Personal Data Devices

- **Maintenance/Construction** – Caltrans provides maintenance services by dispatching vehicles, managing work zone activity, receiving weather information, controlling work zone traffic and vehicle speeds, alerting on work zone intrusion, and sharing these data with other agencies

CHP

- **Center --** Co-located with CT District 12 in Irvine, and is in charge of emergency response on Orange County freeways.
- **Emergency Services** -- Detect all kinds of disasters, receiving incident data from public calls or other Centers, dispatching with computer aid to the Traffic Management Response Team, notify all responding agencies, alert public about severe events or potential disasters, provide related traveler information to the public, and support disaster evacuation, reentry, and recovery

Toll Facilities

- **SR-91 Express Lane** – The TOC is located at 180 N. Riverview Dr, suite 290, Anaheim, CA 92808. Contractors operate the toll facilities and CHP enforce it through contract. The roadway is owned by OCTA. The road is equipped with Loop Detectors, CCTVs, Lighting Sensors, and CMS's. Traveler Information is provided at www.91expresslanes.com. Currently they have delayed and inefficient communication with Caltrans. SR-91 Express Lanes are equipped with transponder readers and violation cameras. Cash is not accepted in SR-91 Express Lanes, which is different from TCA described below.
- **Transportation Corridor Agencies (TCA)** -- Operates Orange County's 67-mile public toll road system includes SR-73, SR-133, SR-241 and SR-261. The TMC is located in Irvine Ranch. TCA will have HOV service by 2015 through a Memorandum of Understanding (MOU) with SCAG. The lanes will revert to Caltrans ownership after 30 years. The road is equipped with Loop Detectors, CCTV (toll road plaza, pay point, and on CMS), Vehicle Probe Readers (Transponder), and Light Curtains/Violation Cameras. Caltrans shares loop detectors and fiber. Traveler Information is provided on the website. More detailed information about TCA can be found at www.thetollroads.com.

Orange County - Resource & Development Management Department (RDMD)

- **Geographic Areas** -- Fragmented Northern OC, Southern OC, Las Flores, Wagon Wheel, and Ladera Ranch.
- **Signals** – RDMD maintains about 200 signals, including over 48 signals in the County's unincorporated areas, those in contract cities and for John Wayne Airport. RDMD also provides contract maintenance for some small cities in Orange County, such as Lake Forest, Laguna Woods, and Laguna Hills. These signals use closed loop/centralized control and have signal preemption for emergency vehicles.

- **Emergency Management** – The Emergency Management Operations Center (EMOC) of RDMD is located at Loma Ridge Facility, Santiago Canyon. There is a new 800 MHz radio system shared amongst OCPD, OCFA, and RDMD. The EMOC dispatch maintenance vehicles, control automated maintenance scheduling, collect road and weather info, monitor work zone traffic and activities, and share maintenance information with other Centers. For weather threats, RDMD activates the "Storm Center" (located at Douglas Rd. south of Katella, and under the direction/control of the Operation and Maintenance Division for the OC).

OCTA

- **Center** – Located in 550 S. Main St. Orange, CA. Responsibilities include bus and paratransit service and maintenance and oversight of MetroLink commuter rail, and the planned CenterLine light rail starter system. The bus and paratransit system is managed from several Bus Bases. OCTA shares transit data with Transtar.
- ITS Systems –
  - AVL -- This system allows a dispatcher to view vehicle location in real time or near real time. The most common technologies use global positioning system (GPS) with wireless data communications to transmit the location data back to the dispatch center. OCTA currently uses an Orbital system.
  - Electronic Payment System – Basic transit fare payment systems are simple "gravity fed" fare boxes where a fare is deposited, verified, and then dropped into a lock box below the fare box. Advances in fare collection include electronic fare boxes that accept paper currency and can compare operator inputs to determine if the correct fare has been inserted. OCTA also uses magnetic stripe swipe card and Genfare GFI "Odyssey" validating fare boxes.
  - Traveler Information – provided on www.octa.net and (714) 636-RIDE, includes transit and carpooling. Carpooling is linked to commutecall.info which produces a customized County service via a regional ridematching engine which is RidePro. RidePro is the underlying system. OCTA later plans to provide route guidance, add a Personal Data Device, Kiosk, and In-Vehicle Systems. Information includes broadcast of static or real-time transit info, and personalized transit info.
  - Traveler Routing – Provided on WWW.OCTA.NET. The underlying system is a trip planning engine. Also there is a proposed multi-modal trip planning demonstration project using web-based services in a demonstration corridor, the SR 91, SR 55, and I 5 between Orange and Riverside Counties. Modes to be included are: freeways, toll-express lanes, carpool lanes, bus routes, and commuter rails (dependent on grant funding).

- SR-91 Express Lane toll facility systems include:a traffic operations center, a call center and voice response system available 24/7, Electronic Toll and Traffic Management system (ETTM), Electronic Toll collection system .

4.2 City Level System

ITS systems owned and operated by the cities in Orange County are summarized in Table 4-1. The Arterial Management Systems in each city are indicated by an "E", which represents that the system already exists. A "P" indicates that the system is planned. Table 4-2 then summarizes the systems for Emergency Management and Maintenance in the same manner.

- **Transportation Management Center (TMC)** – Broadly refers to any center (traffic management center or traffic operation center) that has the capability to monitor, operate, or control a field device, such as a traffic signal or CCTV camera. Two choices of control systems, namely Closed Loop/Centralized Control and Real Time Adaptive Control are given to those cities with TMCs.
- **Vehicle Signal Preemption/Priority**– Provides the ability for emergency vehicles or transit vehicles to change a red light to green as they approach an intersection
- **Advanced Rail/Roadway Intersection Technology** – Goes beyond basic control of traffic at rail crossings, including four-quadrant gates, central control of signal timing, video surveillance and other electronic surveillance devices.
- **Vehicle Detection** – Vehicle detectors such as inductive loop detection and CCTV video imaging processors. These devices have the ability to collect vehicle counts and speeds.
- **Advanced Traveler Information Systems (ATIS)** – Provide real-time traffic/traveler information to the public via a range of communication techniques, such as Dynamic Message Signs, Highway Advisory Radio, In-Vehicle Signing, the Internet, Personal Data Receiving Devices, Kiosks, Email, and Cable TV.
- **Incident Detection System** – An advanced vehicle detection and roadway surveillance system that can identify incidents and provide warnings to the system operator.
- **Data Sharing** – Communication network that can send and receive data about traffic data, images, incidents, emergency and other special events among neighboring cities or between a regional control center and the cities.

Table 4-1: Arterial Management Systems

City	TMC		Signal Preemption		Rail/Roadway Intersection Technology		Vehicle Detection System		ATIS								Arterial Incident Detection
	Closed Loop /Centralized Control	Real-Time Adaptive Control	for Emergency Vehicle	for Transit Vehicle	Center Signal Control	Surveillance	Loop Detector	CCTV	DMS	HAR	In-Vehicle System	Internet	Personal Data Devices	Kiosk	Email	TV	
City of Aliso Viejo	E						E						P				
City of Anaheim	E	E	P	P	E	E	E	P	E	E		P					P
City of Brea	E		E		E												
City of Buena Park	E		E		E	P	P	P	P			P					P
City of Costa Mesa	E	P	E		P	P	E	E	P		P	P	P	P	P	P	P
City of Cypress	E							E									E
City of Dana Point			E														
City of Fountain Valley	E	P						P				P		P			P
City of Fullerton	E	P	E						P								
City of Garden Grove	E		E	P				E	E								E
City of Huntington Beach	E		E		P		P	P	P					P			P
City of Irvine	E		E		E	E	P	E	E	P	P	P		P			P
City of La Habra	E		E														
City of La Palma	No ITS																
City of Laguna Beach	No ITS																
City of Laguna Hills	E		E														
City of Laguna Niguel	E		E				E	E									
City of Laguna Woods	E	E	E				E										
City of Lake Forest	E		E				E	P				E			E		
City of Los Alamitos	No ITS																
City of Mission Viejo	E		P			E	E	P				P		P		P	
City of Newport Beach	E		E				E	P	E								
City of Orange	E	P			P	P		E									
City of Placentia	E				E	P											
City of Rancho Santa Margarita	No ITS																
City of San Clemente			E				E										
City of San Juan Capistrano	E	P	E		P		E										
City of Santa Ana	E	P	E	P	E		E	E	E	E		E		E		E	E
City of Seal Beach	No ITS																
City of Stanton	No ITS																
City of Tustin	E				E												
City of Villa Park	No ITS																
City of Westminster	E		E		E	E		P			P	P	P	P		P	P
City of Yorba Linda	No ITS																

Note: E:--Existing; P—Planned

Table 4-2 summarizes the Emergency Service Systems and Maintenance System in each city. For cities in Orange County, about half of the cities do not have their own emergency response and maintenance system and rely on the County for these services. These cities are marked as “By County” in the table. The other cities have their own emergency centers or fire and police departments that can respond to emergencies. It includes the following subsystems:

- **Emergency Vehicles** – Vehicles that are dispatched to respond to all kinds of emergencies through Computer Aided Dispatching (CAD)
- **Data Sharing** – Commutations between Emergency/Maintenance system and other traffic centers that enable traffic and incident data exchange
- **Monitor System** – Surveillance of transportation infrastructure (e.g. bridges and tunnels) and public travel-related areas (e.g. transit stations and kiosks) for potential threats
- **Disaster Management** –Detection of potential disasters to alert the public and support to the response, evacuation, recovery, and reentry related to the disaster
- **Maintenance/Construction System** – Provide maintenance service to city signal systems by dispatching vehicles, managing work zones, and share work zone status with other traffic agencies

Table 4-2: Emergency Service and Maintenance Service

City	Emergency Vehicle	Data Sharing		Monitor		Disaster		Maintenance/Construction			
	CAD	Receive	Send	Infrastructure	Public Area	Detect	Support	Service	Vehicle	Manage Work Zone	Share MCO Data
City of Aliso Viejo	By County										
City of Anaheim	P							E	E		
City of Brea	By County										
City of Buena Park	E	P	P					E	P		P
City of Costa Mesa	E	P	P			P	E	E	E		P
City of Cypress	By County										
City of Dana Point	By County										
City of Fountain Valley	E										
City of Fullerton	By County										
City of Garden Grove	E	P	P	E		E	E	E	E	E	
City of Huntington Beach								E	E	E	
City of Irvine	E	P		P	E	P	E	E	E	E	P
City of La Habra	By County										
City of La Palma	By County										
City of Laguna Beach	E										
City of Laguna Hills	By County										
City of Laguna Niguel	By County										
City of Laguna Woods	By County										
City of Lake Forest	E										
City of Los Alamitos	By County										
City of Mission Viejo	By County										
City of Newport Beach	E	P	E				E	E	E	E	
City of Orange	E						E	E	E	E	E
City of Placentia	By County										
City of Rancho Santa Margari	By County							E			
City of San Clemente	By County										
City of San Juan Capistrano	By County										
City of Santa Ana							E			P	E
City of Seal Beach								E		E	
City of Stanton	By County										
City of Tustin	By County										
City of Villa Park	By County										
City of Westminster	E			P	P			E	E	E	P
City of Yorba Linda	By City Police & Fire										

Note: E--Existing; P—Planned

5 USER NEEDS AND SERVICES

This section analyzes the needs of the Stakeholders in Orange County. This needs analysis will help identify the gaps between existing systems and future needs. The needs were identified through the surveys, interviews, meetings and local knowledge of the large project team. To help with organized project development, the needs are categorized by ITS User Services.

Table 5-1: Orange County Stakeholder ITS Needs

ITS Category	Needs
Arterial/Traffic Management Examples: • Signal Coordination • Centralized Control • Vehicle Detection Systems • Video System • Adaptive Signal Control • Traffic Management Systems/Centers • Highway Rail Intersection Technologies	Optimize signal system • Completion of infrastructure gaps • Improved coordination of signal timing • Insure compatibility
	Continued operations and maintenance of signal system
	Specialized maintenance for CCTV's, CMS's, communication media such as fiber optics and central software system
	Evolution of city systems from field devices to fully integrated city systems leading to inter-city system integration
	Provide system wide arterial management strategies
	Develop access management plans/strategies (signal spacing)
	Improve signal optimization
	Improve traffic flow monitoring
	Provide more widespread centralized computer control
	Improve hardware issues in interconnecting signal systems between agencies
	Improve or implement ability to remotely modify signal timing

ITS Category	Needs
	Better manage congestion at signals
	Reduce detector failures when pavement fails
	Improve emergency vehicle preemption systems, including faster return to coordination
	Reduce emergency vehicle delays at signals
	Reduce transit vehicle delays at signals
	Improve inter-jurisdictional continuity
	Upgrade signal hardware
	Implement or improve signal coordination
	Better management periods of high traffic demand in poor roadway conditions
	Provide quality real time congestion related information
	Remote monitoring of signal system status/ operations by public safety agencies
	Reduce vehicle traffic delays at grade crossings
	Better coordinate grade crossing operations with signals
	Deploy network vs. corridor based signal coordination
	Toll agencies need better arterial info and special events as they relate to toll customers
	Toll agencies need access to historical traffic count
	Connect and communicate between all traffic signals and the TMCs
	Communicate with adjacent cities
	EVP/ITS and AVL/ITS interconnect
Freeway Management Systems Example: • Vehicle speed detection systems • Video systems • Ramp metering • Variable message signs • Highway advisory radio • Traffic management systems/centers	Deploy additional vehicle detection coverage
	Implement additional field device interconnect
	Improve collection of traffic demand data
	Improve inter-agency coordination
	Improve information exchange between Caltrans District 12 and other Districts
	Improve information exchange between Caltrans District 12 and other local agencies
	Disseminate timely incident information
	Better management of high traffic demand in poor roadway conditions

ITS Category	Needs
	Deploy additional CCTV, CMS, and HAR
	Complete fiber optic communication network
	Upgrade equipment to current standards or better
	Provide quality real time congestion related information
	Have access to historical traffic counts on freeway and toll facilities
	Have access to speed/congestion data
	Have access to on-facility video images
	Restrict access to toll-road video images for security purposes, but share CCTVs with OCFA and Emergency Management Centers.
	Weather alert ability
	Automatic notification of declines in traffic flow
Public Transportation Management Examples: • Public transportation management • En-route transit information • Personalized public transit • Public traveler safety • Traveler service information • Ride matching and reservations • Smart card payment system	Improve regional and interregional trip planning
	Improve patron safety (in-vehicle and at stations)
	Better notification and coordination of special event loads resulting in congestion across city boundaries.
	Provide transit priority at signals
	Improve transit transfers within and between systems and modes to improve service delivery
	Enable dissemination /display of bus arrival times
	Provide quality real time congestion related information
	Toll roads info should be included on all public transportation information system
	Automatic notification of declines in traffic flow
Emergency Management Examples:	Improve incident management, share CCTVs and AVL with TMCs.

ITS Category	Needs
	Provide alternate route plans
	Increase broad understanding of existing incident management procedures
	Improve incidents response coordination between agencies
	Improve incidents detection
	Better information dissemination regarding diversion of trucks
	Improve response to hazardous material incidents
	Provide quality real time congestion information
	Improve traveler information during incidents
	Involve in decision process regarding potential diversion of traffic on or off the toll roads
	Notify public if tolls are waived/resumed
	Notify if completed or under-construction projects can be affected
	Up to date info to review closures, congestion, incidents
	Annual update of County wide street network in GIS format
	Jurisdictional identification of network and devices
	Transit vehicles AVL for emergency notification
Maintenance and	Provide AVL for MCO vehicles

ITS Category	Needs
	Improve work zone traffic handling plan
	Improve detection and removal of dangerous trash barrier on roadways
	Improve coordination of constructions notification and information distribution
	Improve fleet information and management
	Coordinate traffic control plans between jurisdictions
	Increase use of portable control devices
	Provide signal preemption for some maintenance fleet
	Provide real time congestion information
	Improve traveler information
	Need to both receive and disseminate advanced notice of construction and maintenance projects, closures and other issues that affect drivers
	Need to monitor weather, construction progress
	Ability to track maintenance vehicles
	Up to date (via web site) information to review closures, congestion, incidents, etc.
	Annual update of County wide street network in GIS format
	Jurisdictional (i.e. emergency contact) identification of network and devices

ITS Category	Needs
Regional Traveler Information **Examples:** • Enroute traveler information • Pre-trip traveler information • Portable event management systems • In vehicle route guidance • Highway advisory radio • Internet • Media • Tourists information	Provide real time congestion information
	Expand traveler information delivery methods
	Improve Caltrans delay and incident data dissemination
	Use public cable TV to disseminate traffic and weather information
	Improve procedure to obtain information
	Provide information to private information service providers
	Better road construction information
	Vision on 511 system
	Provide en-route traveler information
	Provide traveler information through Internet
	Notify travelers of the toll road options
	Toll road info needs to be included in all RTI systems
	Focal point to refer all citizens on evacuations, fire, road closures
Advanced Vehicle Control and Safety Systems Examples: • Longitudinal collision avoidance • Lateral collision avoidance • Intersection collision avoidance • Vision enhancement for crash avoidance • Automated highway system	Advanced warning signs for excess speed
	Intersection collision avoidance
	Reduce red light running
	Vision Enhancement for crash avoidance
System Integration	Improve information sharing among agencies

ITS Category	Needs
	Improve communication limitations
	Reduce dependency on proprietary systems
	Coordination with schools and office of emergency services
	Provide central information process center
	Reduce impacts of different operating systems for signal control
	Develop integrated GIS
	Develop political agreements
	Improve system compatibility
	Give priority to integrated operations
	Plan the development of projects in a cost-effective manner
	Once ITS standards are set they should not be changed without concurrence on all parties involved
	Emergency preemption devices on signal
	EVP/ITS interconnect
	AVL/ITS interconnect

It should be noted that the vision of working towards a regional network that was identified in the original Orange County ITS plans has not changed. Indeed there is a growing appreciation of the need to develop such a network. There is also a general enhanced appreciation of the importance of the widespread adoption of open architecture standards to facilitate the development of such a network.

6 OPERATIONAL CONCEPT

In Chapter 4 identified the Stakeholders that are associated with each system in the region. In this Chapter, each Stakeholder's current and future roles and responsibilities in the implementation and operation of the regional systems are defined in more detail. The operational concept documents these roles and responsibilities. It provides an "executive summary" view of the way the region's systems will work together to provide ITS services.

6.1 Market Packages

The market packages provide an accessible, service-oriented perspective to the National ITS Architecture. They are tailored to fit, separately or in combination, real world transportation problems and needs that have previously been identified. Market packages collect together one or more equipment packages that must work together to deliver a given transportation service and the architecture flows that connect them and other important external systems. In other words, they identify the pieces of the physical architecture that are required to implement a particular transportation service.

Table 6-1 represents a listing of selected market packages from the National Architecture Version 5.0 for Orange County. Regional ITS Architecture and the operational concept for each stakeholder are identified in Table 6-2.

Table 6-1: Market Package Summary

Archived Data Management	
Archived Data (AD)	
AD2	ITS Data Warehouse
Public Transportation	
Advanced Public Transportation Systems (APTS)	
APTS1	Transit Vehicle Tracking
APTS2	Transit Fixed-Route Operations
APTS3	Demand Response Transit Operations
APTS4	Transit Passenger and Fare Management
APTS5	Transit Security
APTS7	Multi-modal Coordination
APTS8	Transit Traveler Information

Traveler Information	
Advanced Traveler Information Systems (ATIS)	
ATIS1	Broadcast Traveler Information
ATIS2	Interactive Traveler Information
Traffic Management	
Advanced Transportation Management Systems (ATMS)	
ATMS01	Network Surveillance
ATMS02	Probe Surveillance
ATMS03	Surface Street Control
ATMS04	Freeway Control
ATMS06	Traffic Information Dissemination
ATMS07	Regional Traffic Control
ATMS08	Traffic Incident Management System
ATMS10	Electronic Toll Collection
ATMS13	Standard Railroad Grade Crossing
ATMS14	Advanced Railroad Grade Crossing
ATMS15	Railroad Operations Coordination
ATMS16	Parking Facility Management
ATMS17	Regional Parking Management
ATMS18	Reversible Lane Management
ATMS19	Speed Monitoring
ATMS20	Drawbridge Management
ATMS21	Roadway Closure Management
Emergency Management	
Emergency Management (EM)	
EM01	Emergency Call-Taking and Dispatch
EM02	Emergency Routing
EM06	Wide-Area Alert
EM08	Disaster Response and Recovery

Each market package is defined and described in the National Architecture documentation. To gain more insight the necessary material may be found at: http://itsarch.iteris.com/itsarch/

6.2 Orange County ITS System Operational Concepts

From the needs analysis and the inventory of systems the market packages relevant to the Orange County Architecture have been identified. These in turn become the basis for the operational concepts that links market packages to agencies and their roles and responsibilities within them

Operational concepts focus on a definition of each Stakeholders role in providing the region's intelligent transportation systems and services. The operational concept process develops and documents Stakeholders' current and future roles and responsibilities in the implementation and operation of ITS based on a common regional architecture. An operational concept is one of the required components of a regional ITS architecture.

Table 6-2: Operational Concepts

Market Package	Contents	Operating Agency	Roles and Responsibilities
ATMS 1 Network Surveillance	Traffic detectors, other surveillance equipment, the supporting field equipment, and fixed-point to fixed-point communication to transmit the collected data back to the Traffic Management Subsystem	Caltrans District 12	• Install CCTV cameras, CMS and HAR along the freeways • Maintain field equipment • Maintain centralized ramp metering signal systems and software • Maintain AVI/AVL systems for maintenance vehicles
		County	• Assist local cities in installing and maintaining the surveillance equipment on surface street network • Install and maintain the surveillance equipment on surface street network in the contracted cities, the airport and unincorporated areas • Share control of field equipment with other transportation and emergency agencies

Market Package	Contents	Operating Agency	Roles and Responsibilities
		Cities	• Install and maintain the surveillance equipment on surface street network • Share surveillance data with other agencies
ATMS 2 Probe Surveillance	An alternative surveillance approach of network. 2 general paths: 1) wide-area wireless communications between the vehicle and ISP about current vehicle location and status, 2) short range communications between the vehicle and roadside for equivalent information directly to TMC	Caltrans or Cities' TMCs	• Implement roadside network probe surveillance equipment • Operate and maintain probe surveillance equipment • Process, store, and publish surveillance data
		Information Service Providers (ISP)	• Establish road network probe surveillance system • Collect, process, and disseminate surveillance data

Market Package	Contents	Operating Agency	Roles and Responsibilities
ATMS 3 Surface Street Control	Central control and monitoring equipment, communication links, and the signal control equipment that support local surface street control and/or arterial traffic management	County Cities	• Maintain centralized signal systems and software • Monitor traffic on arterials • Manage traffic on arterials using traffic signals including preemptions for emergency vehicles and priority for transit vehicles • Coordinate traffic control responding to incidents which involve emergency and traffic agencies • Share traffic information with other emergency and transportation agencies • Share control of field equipment with other transportation and emergency agencies (if desired) • Share real-time traffic information with Caltrans and adjacent jurisdictions • Maintain field equipment • Maintain resource database updated
		Police, Fire and Other Emergency Services	• Monitor traffic on designated arterials
		Caltrans	• Monitor traffic signal on freeway ramp metering and certain arterials

Market Package	Contents	Operating Agency	Roles and Responsibilities
ATMS 4 Freeway Control	Communication and roadside equipment to support ramp control, lane controls, interchange control, and incident detection for freeways	Toll Agencies	• Operate toll roads, toll collection facilities • Cooperate with Caltrans in traffic detection devices and roadway maintenance • Cooperate with CHP and other emergency services in incidents or disasters • Provide traffic and incident information to emergency and transportation agencies
		Caltrans	• Install CCTV, CMS and other freeway detection devices • Share freeway control data and traffic information with other agencies • Maintain freeway control systems and software • Maintain field equipment • Provide traffic and incident info to drivers • Monitor and manage traffic for Caltrans controlled highways • Monitor and manage traffic for freeway on-ramps, control their signals to include preemption for emergency • Share traffic information with other emergency and transportation agencies • Implement and operate HOV lanes on freeways • Share freeway CCTV, CMS and HAR equipments use (not control) with partner agencies • Determine maintenance vehicle location and send location information to agency centers • Maintain vehicle status for deployment and send status information to agency centers

Market Package	Contents	Operating Agency	Roles and Responsibilities
		OCTA	• Fund plan and coordinate construction of freeway facility improvements, including ITS components • Provide resource when requested by emergency management agency
ATMS 6 Traffic Information Dissemination	Driver information using roadway equipment such as dynamic message signs or highway advisory radio	Caltrans	• Install and maintain the traffic information dissemination equipment along freeways • Update information to ISP and Media Outlets (Websites, TV, etc.) and send alerts on CMS and HAR equipment
		OCTA	• Provide transit information through websites and phone services • Update information to ISP and Media Outlets (Websites, TV, etc.)
		Cities and County	• Install and maintain the traffic information dissemination equipment on surface street network • Provide arterial traffic and incident information to the public • Update information to ISPs and Media Outlets (websites, TV, etc.) and send alerts on CMS and HAR equipment

Market Package	Contents	Operating Agency	Roles and Responsibilities
ATMS 7 Regional Traffic Control	Sharing of traffic information and control among traffic management centers to support a regional control strategy. Adding the communication links and integrated control strategies that enable integrated inter-jurisdictional traffic control	Caltrans	• Develop policies and agreements between and among local agencies to connect and share the use of conduit
		OCTA and County	• Develop policies and agreements between and among local agencies to connect and share the use of conduit • Assist with funding for regional projects
		Cities	• Participate in and contribute to the integration process
ATMS 8 Traffic Incident Management System	Managing both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized	CHP	• Receive public safety calls and forward them to appropriate dispatch center • Respond to incident by coordinating with field staff • Communicate with other emergency and traffic agencies to support coordinated emergency response when necessary • Monitor traffic on designated arterials • Keep resource database updated • Enforce traffic violations on highways • Dispatch state patrol vehicles • Provide incident status information • Report freeway road closure to all agencies

Market Package	Contents	Operating Agency	Roles and Responsibilities
		Police, Fire and other Emergency Services	• Monitor traffic on designated arterials • Provide traffic and incident information to drivers • Maintain centralized emergency management systems software and systems • Share CCTV, CMS and HAR equipment and its control with partner agencies • Maintain updated resource database • Report road closure to all agencies • Enforce traffic violations on arterial streets
		Caltrans	• Collect incident data and confirm incident time and location • Provide traffic and incident information to drivers • Implement traffic control responding to incidents • Provide resources when requested by emergency agencies • Coordinate road closure with other agencies • Coordinate the development and maintenance of disaster response and evacuation plans • Coordinate traffic control and incident response with other agencies
		Cities	• Provide resources when requested by emergency agency

Market Package	Contents	Operating Agency	Roles and Responsibilities
ATMS 10 Electronic Toll Collection	Collect tolls electronically and detect and process violations	OCTA operating through contractors	• Install, maintain and operate electronic collection system • Keep toll record and archive data • Detect violations
		TCA	• Install, maintain and operate electronic collection system • Keep toll record and archive data • Detect and process violations
ATMS 13 Standard Railroad Grade Crossing	Manages highway traffic at highway-rail intersections where operational requirements do not dictate more advanced features. Both passive and active warning systems are supported	Railroad Operators	• Operate rail service by the requirements listed in the railroad crossing plan
		Cities	• Install and maintain the railroad crossing equipments for detections and warning
		OCTA	• Develop railroad crossing management plan
ATMS 16 Parking Facility Management	Provides enhanced monitoring and management of parking facilities	Cities	• Collect parking capacity and status data Share data with ISP and other agencies
		ISP	• Disseminate parking capacity and status data
		OCTA	• Provide transit connection related parking information
ATMS 18 Reversible Lane Management	Provides for the management of reversible lane facilities	Caltrans/County	• Provide lane direction information and access control
		Cities	• Provide Lane direction information

Market Package	Contents	Operating Agency	Roles and Responsibilities
ATIS 1 Broadcast Traveler Information	Collects traffic conditions, advisories, general public transportation, incident information, roadway maintenance and construction information, weather information, and broadly disseminates this information through existing infrastructures	Caltrans	• Provide traffic and incident information to drivers • Share traffic information with other emergency and transportation agencies • Share control of field equipment with other transportation and emergency agencies • Maintain AVI/AVL systems for maintenance vehicles • Update information to ISP and Media Outlets (Websites, TV, etc.) and send alerts on CMS and HAR equipment
		Cities	• Provide arterial traffic and incident information to the public • Update information to ISPs and Media Outlets (websites, TV, etc.) and send alerts on CMS and HAR equipment
		OCTA	• Maintain transit AVI/AVL system • Assist with funding, planning, and coordinating regional projects
		CHP	• Provide traffic and incident information to the public • Update information to ISP and other Media Outlets (websites, TV, etc.) and issue alerts on CMS and HAR equipments • Report highway road closure to all agencies • Keep resource database updated

Market Package	Contents	Operating Agency	Roles and Responsibilities
		Police, Fire and other Emergency Services	• Communicate with other agencies to coordinate emergency response when necessary • Provide traffic and incident information to drivers • Share CCTV, CMS and HAR equipment and its control with partner agencies • Maintain resource database updated • Report road closure to all agencies
ATIS 2 Interactive Traveler Information	Provides tailored information in response to a traveler request	OCTA	• Establish and maintain itinerary planning website
APTS 1 Transit Vehicle Tracking	Monitors current transit vehicle location using AVL	OCTA	• Establish transit vehicle tracking system • Install tracking equipment • Operate the tracking system to monitor vehicle location • Keep record and archive data

Market Package	Contents	Operating Agency	Roles and Responsibilities
APTS 2 Transit Fixed-Route Operations	Vehicle routing and scheduling, as well as automatic operator assignment and system monitoring for fixed-route and flexible-route transit services	Caltrans District 12	• Provide traffic and incident information to drivers • Coordinate road closure with other agencies
		OCTA	• Plan and manage transit system • Receive bus location from AVI/AVL and send bus status to transit centers • Receive and archive bus occupancy information • Maintain transit AVI/AVL system • Maintain transit center software and systems • Maintain vehicle status and send status information to transit centers • Fund, implement, and operate transit traveler information for Orange County, obtain usage statistics and monitor the performance
		Cities	• Maintain city signal systems • Maintain field equipment • Coordinate road closures with other agencies
APTS3 Demand Response Transit Operations	Vehicle routing and scheduling as well as automatic operator assignment and monitoring for demand responsive transit services	OCTA	• Receive ride request • Schedule and dispatch vehicle in a systematic manner • Coordinate with other transit operators to achieve inter-jurisdictional service • Send status to agency center

Market Package	Contents	Operating Agency	Roles and Responsibilities
APTS 4 Transit Passenger and Fare Management	Manages passenger loading and fare payments on transit vehicles using electronic means	OCTA	• Establish transit passenger and fare management system • Operate and maintain the transit passenger and fare management system • Keep record of the performance and archive data
APTS 5 Transit Security	Provides for the physical security of transit passengers and transit vehicle operators	OCTA	• Monitor transit vehicle security • Monitor transit related public area • Receive security call from transit drivers • Maintain the communication network with transit vehicles and emergency services
		Emergency Service	• Receive emergency call from transit service • Dispatch emergency vehicle
APTS 7 Multimodal Coordination	Establishes two way communications between multiple transit and traffic agencies to improve service coordination	OCTA Other Agencies	• Maintain the communication network with other agencies • Coordinate transit service with other agencies
APTS 8 Transit Traveler Information	Provides transit users at transit stops and on-board transit vehicles with ready access to transit information	CHP	• Report highway road closure to all agencies
		OCTA	• Provide transit schedule and route information through Website, telephone services, and other ISP

Market Package	Contents	Operating Agency	Roles and Responsibilities
EMS 1 Emergency Call-Taking and Dispatch	Basic public safety call-taking and dispatch services	Caltrans District 12	• Monitor and manage traffic for Caltrans controlled highways • Monitor and manage traffic for freeway on-ramps, control their signals to include preemption for emergency • Implement traffic control responding to incidents • Share traffic information with other emergency and transportation agencies • Provide resources when requested by emergency agencies • Update information to ISP and Media Outlets (Websites, TV, etc.) and send alerts on CMS and HAR equipment • Coordinate the development and maintenance of disaster response and evacuation plans • Assume a leading role in traffic diversion and implementation of traffic management schemes under circumstances of severe incidents and disasters
		Toll Agencies	• Cooperate with CHP and other emergency services in incidents or disasters • Open access to general public in emergency or disasters

Market Package	Contents	Operating Agency	Roles and Responsibilities
		Cities	• Monitor traffic on arterials • Implement traffic control responding to incidents • Coordinate traffic control responding to incidents which involve emergency and traffic agencies • Share traffic information with other emergency and transportation agencies • Share real-time traffic information with Caltrans and adjacent jurisdictions • Provide resources when requested by emergency agency • Coordinate road closures with other agencies • Update information to ISPs and Media Outlets (websites, TV, etc.) and send alerts on CMS and HAR equipment
		OCTA	• Maintain vehicle status and send status information to transit centers

Market Package	Contents	Operating Agency	Roles and Responsibilities
		CHP	• Assume a leading role in handling and clearance of incidents on highways. • Receive public safety calls and forward them to appropriate dispatching center • Dispatch patrol vehicles • Create, store, and utilize emergency response plans to facilitate coordinated response • Monitor traffic on designated arterials • Provide traffic and incident information to the public • Maintain centralized emergency management systems software and systems • Perform other non-transportation related public safety duties • Update information to ISP and other Media Outlets (websites, TV, etc.) and issue alerts on CMS and HAR equipments • Report highway road closure to all agencies • Keep resource database updated

Market Package	Contents	Operating Agency	Roles and Responsibilities
		Police, Fire and Other Emergency Services	• Receive public calls and forward them to appropriate dispatch centers • Dispatch police, fire, ambulance, and other emergency vehicles • Create, store, and utilize emergency response plans to facilitate coordinated response • Monitor traffic on designated arterials • Provide traffic and incident information to drivers • Maintain centralized emergency management systems software and systems • Report road closure to all agencies
EMS 2 Emergency Routing	Automated vehicle location and dynamic routing of emergency vehicles	Caltrans	• Provide traffic and incident information to drivers • Coordinate traffic control responding to incidents which involve emergency and other transportation agencies • Coordinate road closure with other agencies
		CHP	• Communicate with other emergency and traffic agencies to support coordinated emergency response when necessary • Track and manage emergency vehicles fleets using AVL and two-way communications with the vehicle fleet • Receive real-time traffic from other agencies to optimize the emergency dispatching in selecting the emergency vehicles and routes

Market Package	Contents	Operating Agency	Roles and Responsibilities
		Police, Fire and other Emergency Services	• Communicate with other agencies to coordinate emergency response when necessary • Track and manage emergency vehicle fleets using AVL and two-way communications with the vehicle fleet • Receive real-time traffic information to optimize emergency vehicle dispatching
EM 6 Wide Area Alert	Uses ITS driver and traveler information systems to alert the public in emergency situations that pose a threat to life and property	OC Sheriff's Dept. Communication Center	• Receive alert information • Disseminate alert to other emergency services and ISPs
		ISP	• Disseminate alert information
		CHP, Fire, Police, and other EMS	• Disseminate alert information
EM 8 Disaster Response and Recovery	Enhances the surface transportation system to respond to and recover from disasters	All EMS (Sheriff, CHP, Fire, etc.)	• Collect disaster status • Send out request of resources to all centers
		Caltrans	• Provide road network status • Coordinate with EMS on emergency traffic control
		OCTA	• Provide transit status • Provide emergency transit service

Market Package	Contents	Operating Agency	Roles and Responsibilities
AD 2 ITS Data Warehouse	Data collection, management, and functionality & interface definitions that allow collection of data from multiple agencies & data sources spanning across modal & jurisdictions	Caltrans	• Host and coordinate data collection, data management, and data exchange • Utilize the data for planning and management
		OCTA	• Host and coordinate data collection, data management, and data exchange • Utilize the data for planning and management
		Cities TMC	• Collect, store, and achieve transportation data

The above information on roles and responsibilities will be useful when Stakeholders are considering specific project architectures and wish to identify the necessary Stakeholders to include or refer to. The table is also helpful when considering agreements that will be necessary to implement projects that impact multiple Stakeholders.

7 Functional Requirements

At this point the needs, services and market packages and the roles of the agencies have been defined in continuing to develop ITS services in Orange County. The next part of the puzzle is to list the tasks or activities that are performed by the systems themselves. This can either be the existing systems or those that are planned. Functional requirements can be high level in nature for a plan such as this or for a project architecture leading to procurement of a system. They will by necessity be very detailed. The level of requirements on this occasion is written at a level that tries to indicate what is involved for the understanding of Stakeholders but avoids potential detail.

This chapter provides input to the identification of interfaces and information flows of the architecture, as well as a resource for project planners in defining activities and functional relationships of the systems that may be developed or upgraded to provide Orange County ITS Architecture or Southern California Regional ITS Architecture. The functional requirement serves as optional guidance to regional ITS deployment and is not mandatory.

A list of requirements that describe the functions covered by the architecture is a requisite component of the architecture according to the FHWA Final Rule for Architecture and Standards. This list of requirements describes the functionality of the existing and planned elements of the architecture for providing Southern California Regional ITS Architecture and Orange County ITS Architecture. The architecture does not prescribe that future projects meet any or all of the requirements. However, the Rule/Policy specifically requires on maintaining an open architecture, unbiased towards any particular products. Use of open standards is a priority of the architecture. All subsystems in the architecture will support a range of existing or anticipated product offerings from an unlimited range of hardware or service providers. In California, this requirement is reinforced by legislation AB3418. AB3418 is a 1995 Caltrans communications standard that ensures interconnectivity of traffic signal control devices, and does so by utilizing existing communication standards and models. AB3418 specifies parts of the NTCIP and ISO/IE specifications for the data link layer but specifies a fixed set of messages related to traffic signal controllers.

The following section lists the primary functional requirements for the major ITS elements in Orange County.

Stakeholder: California Highway Patrol (CHP)

System: CHP Emergency Operation Center

This system shall:

- Support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator.

- Receive emergency call information from 911 services and present the possible incident information to the emergency system operator.
- Receive emergency call information from motorist call boxes, other public safety agencies, transit systems, commercial vehicles/check stations and present the possible incident information to the emergency system operator.
- Coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence.
- View CCTV systems within traffic management center in order to verify the reported incident.
- Update the incident information log once the emergency system operator has verified the incident.
- Forward the verified emergency information to the responding agency based on the location and nature of the emergency.
- Dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control.
- Store the current status of all emergency vehicles available for dispatch and those that have been dispatched.
- Relay location and incident details to the responding vehicles.
- Provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.
- Track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.
- Coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.
- Collect current traffic and road condition information from traffic management centers for emergency vehicle route calculation.
- Receive inputs from traffic management and maintenance centers on the location and status of traffic control equipment and work zones along potential emergency routes.
- Calculate emergency vehicle routes based on information from traffic management and maintenance centers.
- Provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.
- Develop and coordinate with other agencies, to store emergency response plans.

- Track the availability of resources (including vehicles, roadway cleanup, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.
- Allocate the appropriate emergency services, resources, and vehicle(s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.
- Provide information to the media concerning the status of an emergency response.

Stakeholder: California Highway Patrol (CHP)

System: CHP Emergency Vehicles

This system shall:

- Send the vehicle's location and operational data to the center for emergency management and dispatch.
- Receive incident details and a suggested route when dispatched to a scene.
- Send the current en-route status (including estimated time of arrival) and requests for emergency dispatch updates.
- Send requests to traffic signal control equipment at the roadside to preempt the signal.
- Receive dispatch instructions sufficient to enable emergency personnel in the field to implement an effective incident response. It includes local traffic, road, and weather conditions, and hazardous material information.
- Provide an interface to the center for emergency personnel to transmit information about the incident site such as the extent of injuries, identification of vehicles and people involved, hazardous material, etc.
- Provide an interface to the center for emergency personnel to transmit information about the current incident response status such as the identification of the resources on site, site management strategies in effect, and current clearance status.

Stakeholder: Caltrans District 12

System: Caltrans District 12 TMC

This system shall:

- Monitor, analyze, and store traffic sensor data (speed, volume, and occupancy), CCTV real time pictures and high occupancy vehicle (HOV) lane sensor data collected from field elements under remote control of the center.

- Support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic data.
- Distribute road network conditions data (raw or processed) based on collected and analyzed traffic sensor and surveillance data to other centers.
- Respond to control data from center personnel regarding sensor and surveillance data collection, analysis, storage, and distribution.
- Remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
- Collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
- Implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.
- Remotely control sensors to detect high-occupancy vehicle (HOV) lane usage.
- Remotely control freeway control devices, such as ramp signals and mainline metering and other systems associated with freeway operations that control use of HOV lanes.
- Collect traffic flow measures and information regarding vehicle occupancy (i.e., lane usage) in HOV lanes.
- Collect operational status for the freeway control devices associated with HOV lane control.
- Collect fault data for the freeway control devices associated with HOV lane control for repair.
- Remotely control changeable message signs for dissemination of traffic and other information to drivers.
- Remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.
- Collect operational status for the driver information systems equipment (CMS, HAR, etc.).
- Distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.
- Distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.
- Collect and store traffic flow and image data from the field equipment to detect and verify incidents.

- Exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.
- Provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.
- Provide video and traffic sensor control commands to the field equipment to detect and verify incidents.
- The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers and traveler information service providers.
- Support request from adjacent Caltrans Districts to remotely control field elements.
- Support requests from local and regional agencies in Orange County to remotely control CCTV cameras.

Stakeholder: Caltrans District 12

System: Caltrans District 12 TMC Roadside Equipment

This system shall:

- Collect, process, estimate, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.
- Collect, process, and send traffic images to the center for further analysis and distribution.
- Collect, digitize, and send high occupancy vehicle (HOV) lane sensor data to the center for further analysis and storage.
- Return sensor and CCTV system operational status to the controlling center.
- Include ramp metering controllers, mainline meters, and lane controls for use on freeways, under center control.
- Monitor operation of ramp meter, mainline meters, and lane control indicators and report to the center any instances in which the indicator response does not match that expected from the indicator control information.
- Return ramp metering controller, mainline meters, and lane control operational status to the controlling center.
- Include sensors to detect high-occupancy vehicle (HOV) lane usage, under center control.

- Include driver information systems to notify users of lane status for lanes that become HOV or High Occupancy Toll (HOT) lanes during certain times of the day on freeways, under center control.
- Include freeway control devices, such as ramp signals and mainline metering and other systems associated with freeway operations that control use of HOV lanes, under center control.
- Provide traffic flow measures and information regarding vehicle occupancy (i.e., lane usage) in HOV lanes to the center.
- Return operational status for the HOV lane sensors to the controlling center.
- Collect, process, and send traffic images to the center for further analysis and distribution to other TMCs.
- The field element's video devices shall be remotely controlled by a traffic management center.

Stakeholder: Caltrans District 12

System: Caltrans District 12 MCO Dispatch Center

This system shall:

- Maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information.
- Respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
- Exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables supply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays and closures.
- Receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
- Dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.

- Track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.
- Generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
- Disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.
- Control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.

Stakeholder: Caltrans District 12

System: Caltrans District 12 MCO Vehicles

This system shall:

- Monitor materials information including remaining quantity and current application rate of materials on the vehicle.
- Respond to dispatch information from the center, presented to the vehicle operator for acknowledgement and returning status.
- Send operational data to the center including the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), types and quantities of materials used for construction and maintenance.
- Monitor, operate, and control work zone devices located at or alongside the roadway. The devices operated on board the vehicle include driver information devices (e.g. dynamic message signs)
- Provide an interface for field personnel to input status of their work zone activities.

Stakeholder: County and Cities

System: County and Emergency Services (City Fire & Police)

This system shall:

- Receive emergency call information from 911 services and present the possible incident information to the emergency system operator.
- Coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence.
- Update the incident information log once the emergency system operator has verified the incident.

- Dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control with AVL.
- Relay location and incident details to the responding vehicles.
- Track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.
- Receive traffic information, including closures, traffic conditions, etc. from traffic management centers.
- Develop and coordinate with other agencies, to store emergency response plans.
- Receive and distribute event scheduling information from Event Promoters.

Stakeholder: County and Cities

System: County and Emergency Vehicles (City Fire & Police)

This system shall:

- Shall receive dispatch instructions sufficient to enable emergency personnel in the field to implement an effective incident response. It includes local traffic, road, and weather conditions, hazardous material information, and the current status of resources that have been allocated to an incident.
- Provide an interface to the center for emergency personnel to transmit information about the incident site such as the extent of injuries, identification of vehicles and people involved, hazardous material, etc.
- Provide an interface to the center for emergency personnel to transmit information about the current incident response status such as the identification of the resources on site, site management strategies in effect, and current clearance status.

Stakeholder: Cities

System: City TMC

This system shall:

- Remotely monitor and control traffic signal controllers.
- Remotely control CCTV, CMS and other traffic control devices
- Implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents and emergency vehicle preemptions.
- Collect and store traffic flow and image data from the field equipment to detect and verify incidents.

- Receive inputs concerning upcoming events that would affect the traffic network from event promoters, traveler information service providers, and intermodal freight depots.
- Exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.
- Interface with other TMC's for interagency data exchange & functionality sharing

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Stakeholder: Cities

System: City TMC Roadside Equipment

This system shall:

- Provide the capability to notify the traffic management center that a pedestrian has requested right-of-way and when the request was or will be granted (request for right-of-way).
- Return traffic signal controller operational status to the controlling center.
- Include dynamic messages signs for dissemination of traffic and other information to drivers, under center control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close).
- May include driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers, under center control.
- Provide operational status for the driver information systems equipment (CMS, HAR, etc.) to the center, and verification of what is being displayed.
- Collect, process, and send traffic images to the center for further analysis and distribution.
- Remotely process video data and provide an indication of potential incidents to the traffic management center. Communications infrastructure shall be robust to handle the bandwidth needed for multiple camera use by multiple agencies.
- Be remotely controlled by a traffic management center.

Stakeholder: OCTA and TCA

System: SR-91 and Other Toll Roads

This system shall:

- Manage toll transactions, including maintaining a log of all transactions and toll pricing structure information.
- Process the financial information from toll plazas and manage an interface to a Financial Institution for electronic toll payments requiring financial payment.
- Manage the details of toll payment violations based on tag information from the toll plaza, vehicle registration information from the Department of Motor Vehicles, invalid tag information from a Financial Institution, and previous violations.
- Support wide-area alerts from emergency centers by passing on the information to its toll plazas and the toll road operation center.
- Read data from vehicle toll tags to support toll payment transactions.
- Update the toll tag value after debiting the toll amount and send a record of the transaction to a center.
- Read the credit identity on the toll tag and send that identity and the amount to be debited to a center.
- Reconcile accounts with other toll providers.

Stakeholder: OCTA

System: Bus Base (Transit Operation)

This system shall:

- Monitor the locations of all transit vehicles within its network.
- Determine adherence of transit vehicles to their assigned schedule.
- Collect monitoring data from on-board systems including transit vehicle mileage, fuel usage, passenger loading, availability, etc.
- Provide transit operational data to traveler information service providers.
- Generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, operational data on current routes and schedules, and digitized map data.
- Provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes. Collect transit operational data for use in the generation of routes and schedules.
- Exchange information with maintenance and construction operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.

- Disseminate up-to-date schedules and route information to other centers for fixed and flexible route services.
- Collect operational and maintenance data from transit vehicles.
- Generate transit vehicle maintenance schedules, includes what and when the maintenance or repair is to be performed.
- Generate transit vehicle availability listings, current and forecast, to support transit vehicle assignment planning based, in part, on the transit vehicle maintenance schedule.
- Assign technicians to a transit vehicle maintenance schedule, based upon such factors as personnel eligibility, work assignments, preferences and seniority.
- Collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc.

Stakeholder: OCTA

System: (714) 636-RIDE/OCTA.NET (Transit Information)

This system shall:

- Provide the capability to process voice-formatted requests for transit traveler information from a transit traveler telephone information system.
- Provide the capability to process dial tone and touch tone requests for transit traveler information from a traveler telephone information system.
- Provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents and weather.
- Exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems.
- Provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation.

Stakeholder: OCTA

System: Transit Vehicles

This system shall:

- Receive transit route information for its assigned route including transit service instructions, traffic information, road conditions, and other information for the operator.
- Calculate the estimated times of arrival (ETA) at transit stops.

- Detect embarking travelers on-board a transit vehicle and read data from the traveler card/payment instrument that they are carrying.
- Calculate the traveler's fare based on the origin and destination provided by the traveler as well as factors such as the transit routing, transit fare category, traveler history, and route-specific information.
- Provide a transit fare payment interface that is suitable for travelers with physical disabilities.
- Provide passenger loading and fare statistics data to the center.

8 ITS Interconnects and Architecture Flows

The point is reached in the architecture where it is possible to really see the outline of a framework for integrating systems to finally reap the benefits of sharing data. For the National Architecture Interconnects and Flows is the point at which the framework for integration is identified and the potential flows are examined. We begin with a frequently used high level conceptual diagram that depicts the physical systems in a region that can be interconnected. Figure 8-1 is often referred to as “the sausage diagram”. It should be viewed as a top-level expression of connectivity.

At an early stage in this project, discussions with Stakeholders returned to the earlier concept that the Master Plan referred to in Chapter 1, had envisaged for an Orange County Wide Area Network (WAN) for exchanging data. The network had explicitly considered an ultimate network built on fiber connections. The vision created for the 2005 version of the Orange County Regional ITS Architecture no longer identifies the communication technology needed for a network. Changes in the costs and potential of communication technology make it unwise to predict what these will be. Nor is it envisioned that a completed network lies in the immediate future but rather that pieces will be built incrementally. Figure 8-3 depicts a conceptual potential interconnect diagram. But the reality is likely to be based on small numbers of agencies connecting together and gradually building out connections to accept more partners over time. A network of cameras that could potentially be shared by many is one such example.

There are many ways to represent the depiction of the potential data flows between systems. The US DOT Regional ITS Architecture Guidance (2001) discusses the alternatives. The consultant team has focused on the use of customized market packages, which is one of the alternative methods discussed. These market package diagrams are customized for Orange County. The existing general system interconnects are illustrated in Figure 8-2, and the proposed future general system interconnects are illustrated in Figure 8-3. Figure 8-4 and Figure 8-5 are simplified system diagrams of the Emergency Services and Transit Services. Figure 8-6 through Figure 8-30 present the detailed information flows among OC elements by Market Packages. These diagrams documented the information flows in terms of certain functions performed in the ITS system. The categorization of cities into tier 1, tier 2 and tier 3 reflects the level of ITS development and integration. Tier 1 cities have advanced ITS systems and are actively seeking inter-modal and inter-agency integration. Tier 2 cities have their own ITS systems but no system integration with other jurisdictions, while Tier 3 cities are at the simplest level of development. The detailed listing is given in Appendix C.

A second means of displaying interconnect information is through the use of the software tool TurboArchitecture™. Appendix F contains listings for all of the interconnects, as well as information flows between two ITS elements. Appendix G outlines interconnect diagrams covering all systems. It should be noted, that the existence of a connection indicated by a smooth line, need not be more than a telephone or fax connection and does not refer to the existence of a data connection.

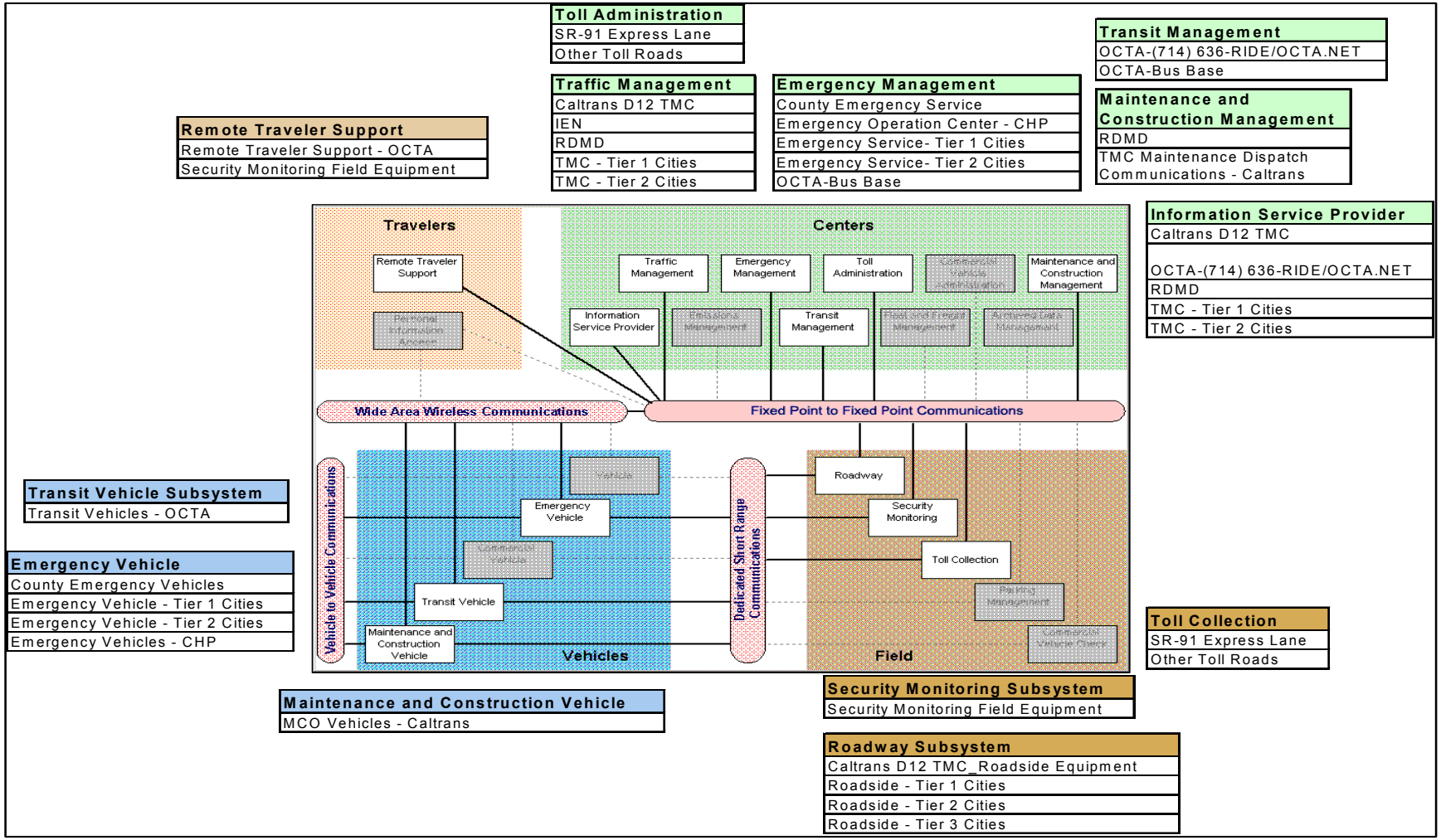

Figure 8-1: Orange County Physical Architecture Interconnects

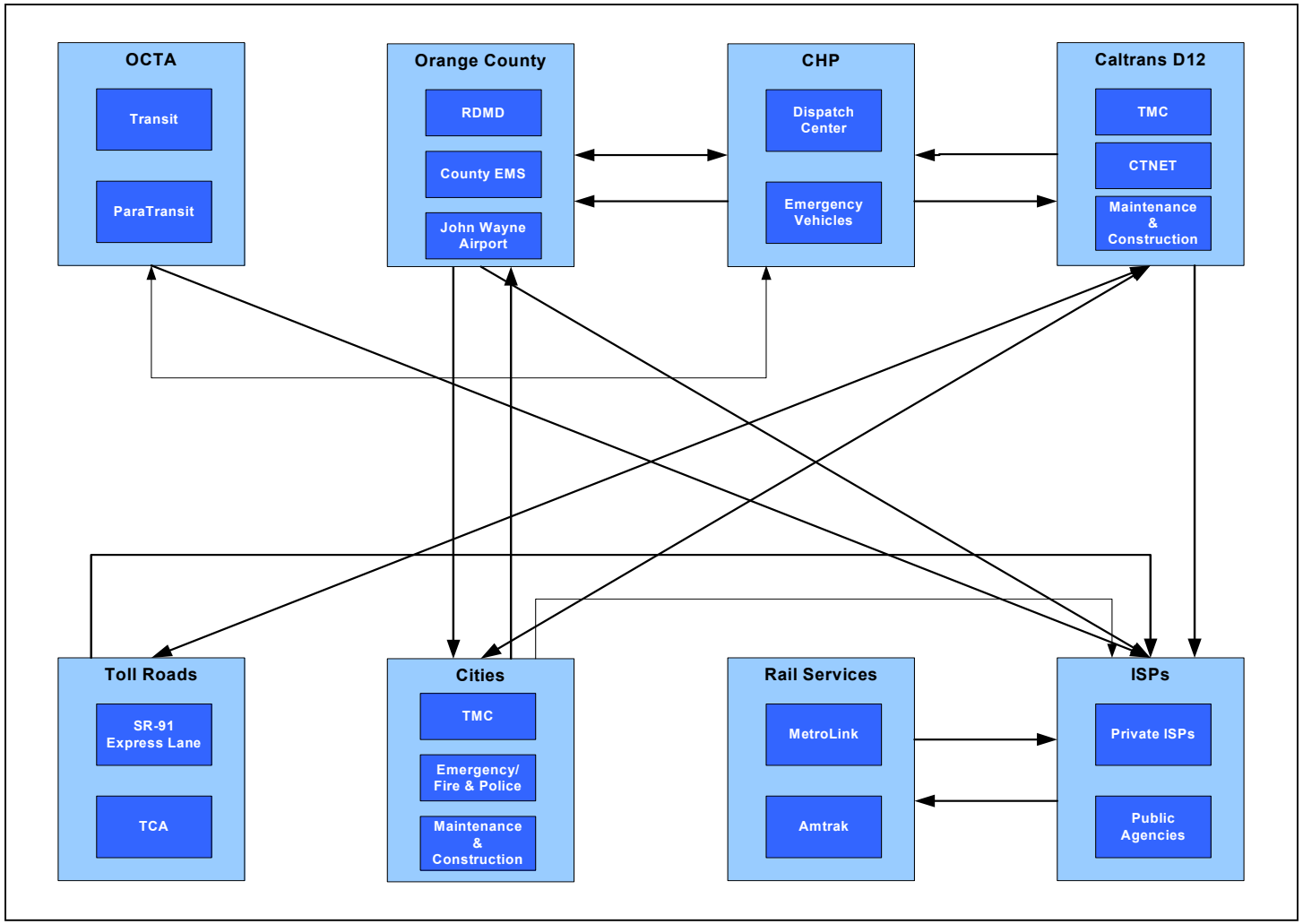

Figure 8-2: Orange County Current Interconnects

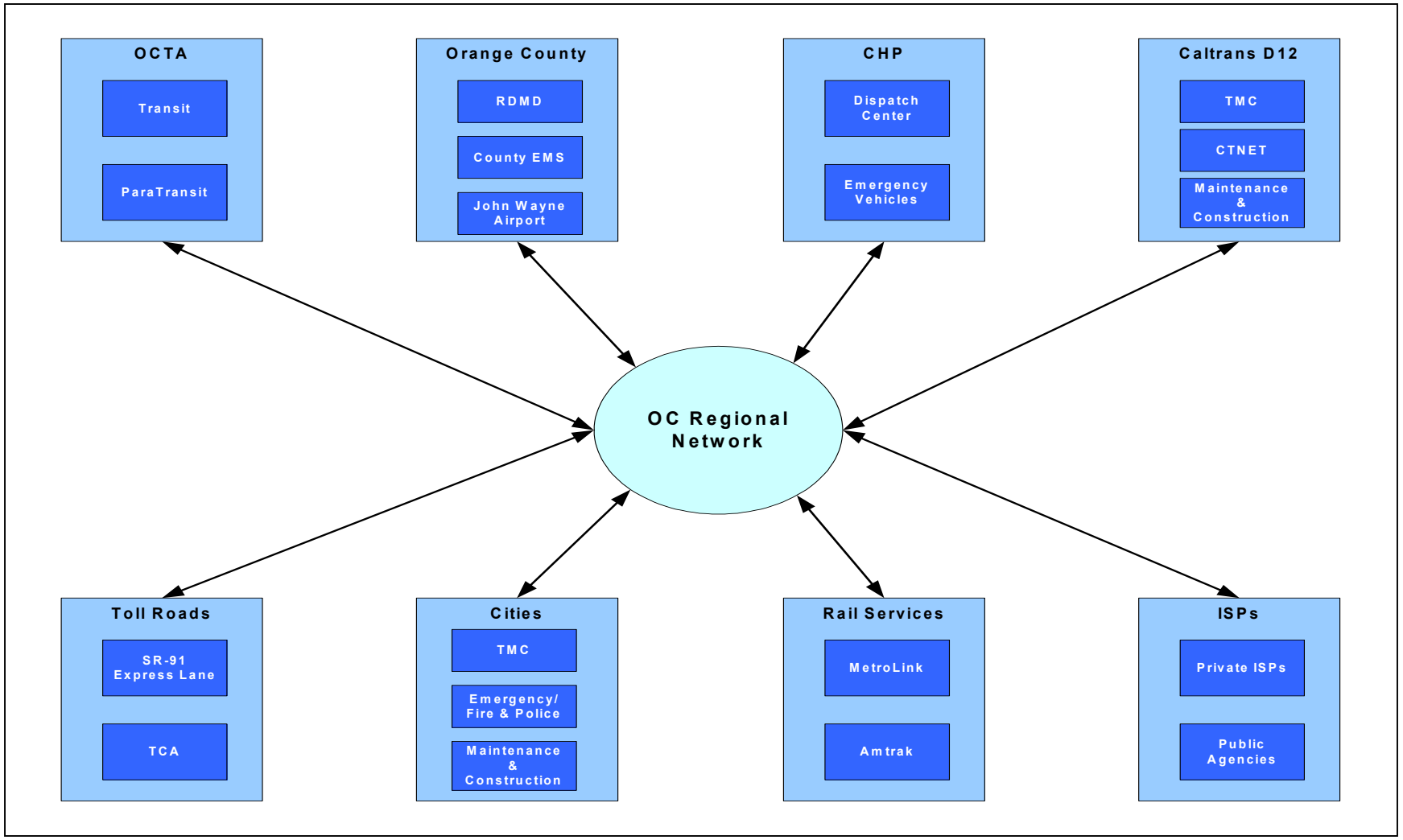

Figure 8-3: Orange County Future Conceptual Network (Flows undefined)

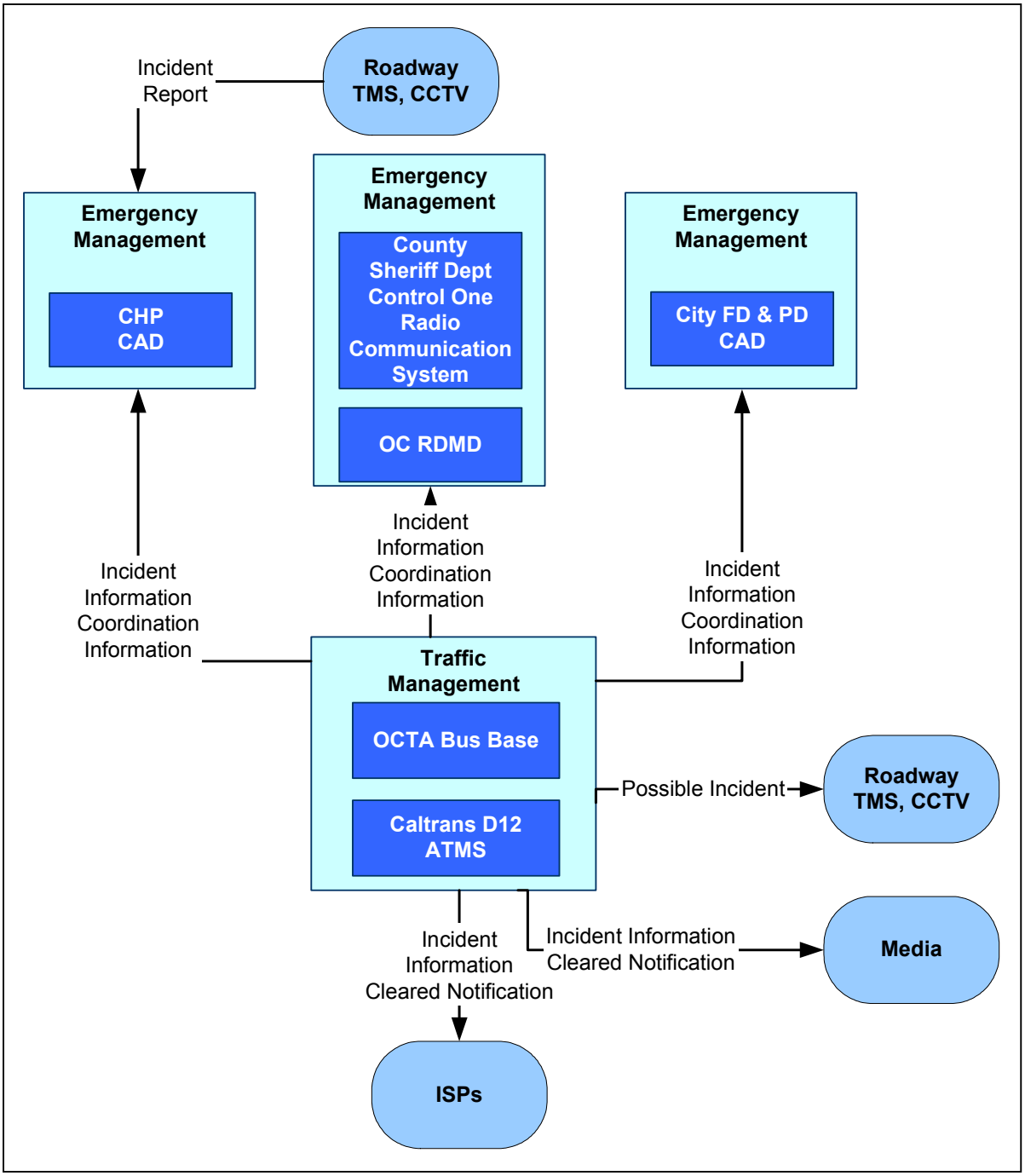

Figure 8-4: Orange County Emergency Management Interconnects and Flows

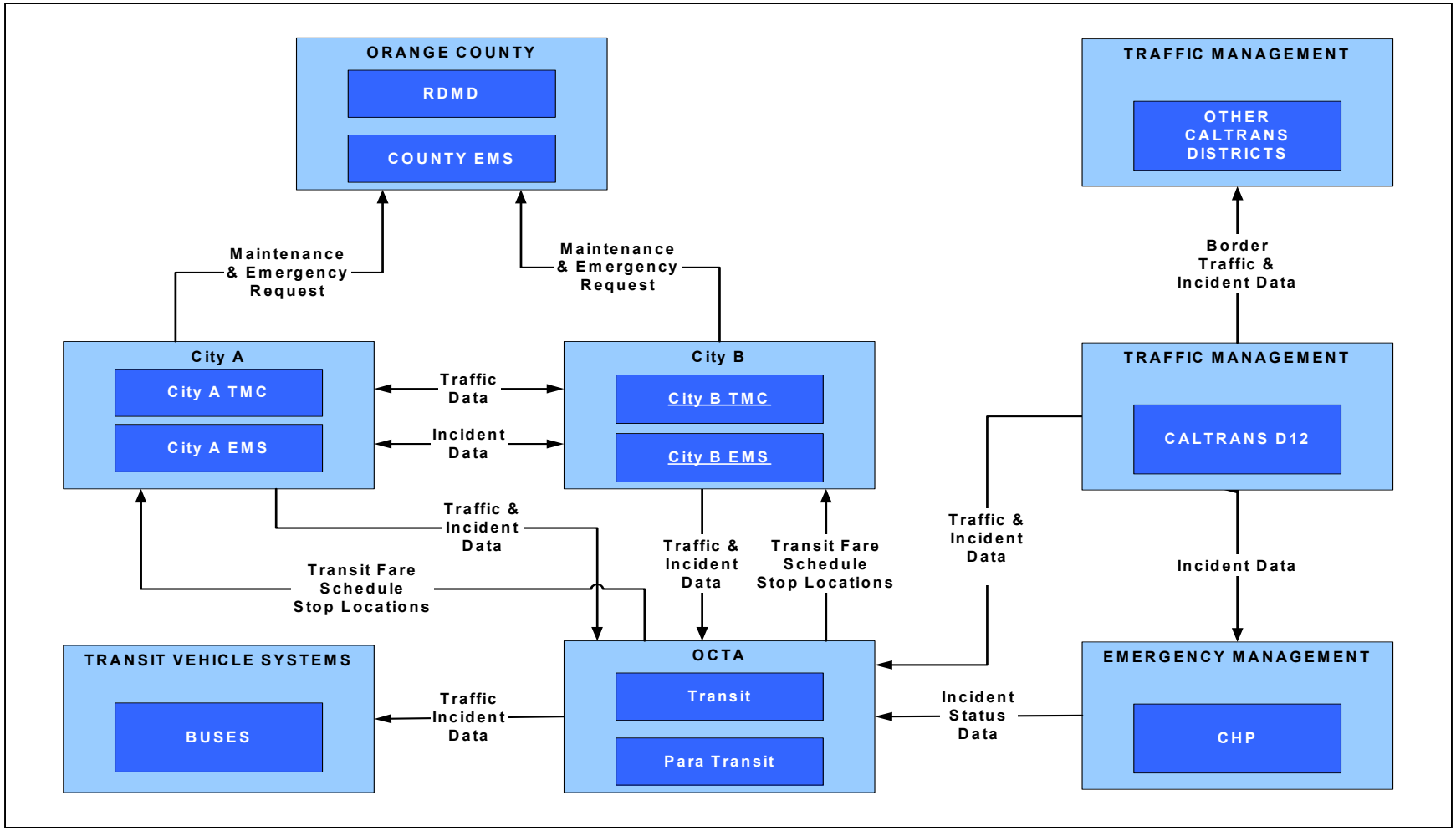

Figure 8-5: Orange County Transit Management data flows

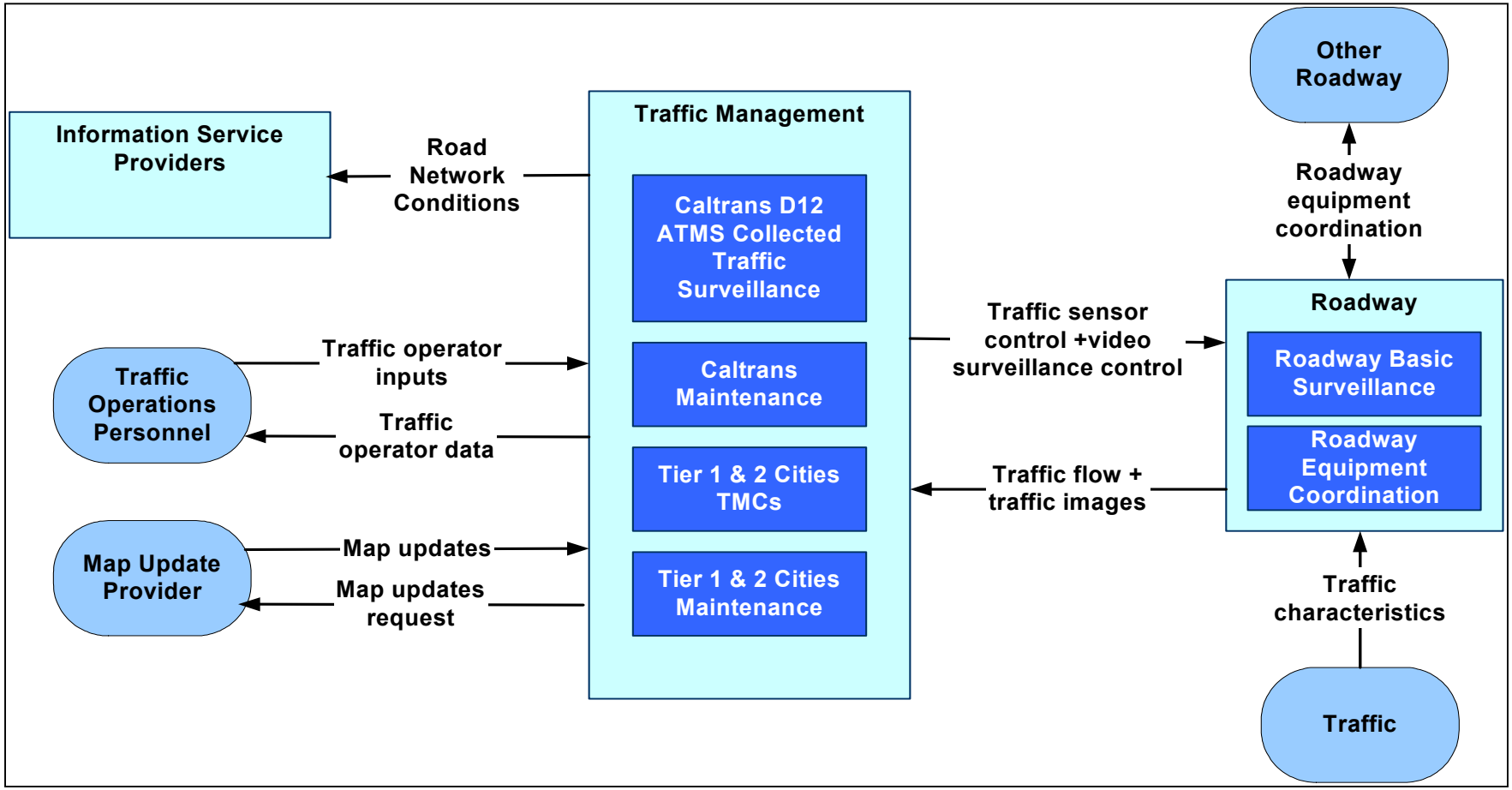

Figure 8-6: ATMS 1 -- Network Surveillance

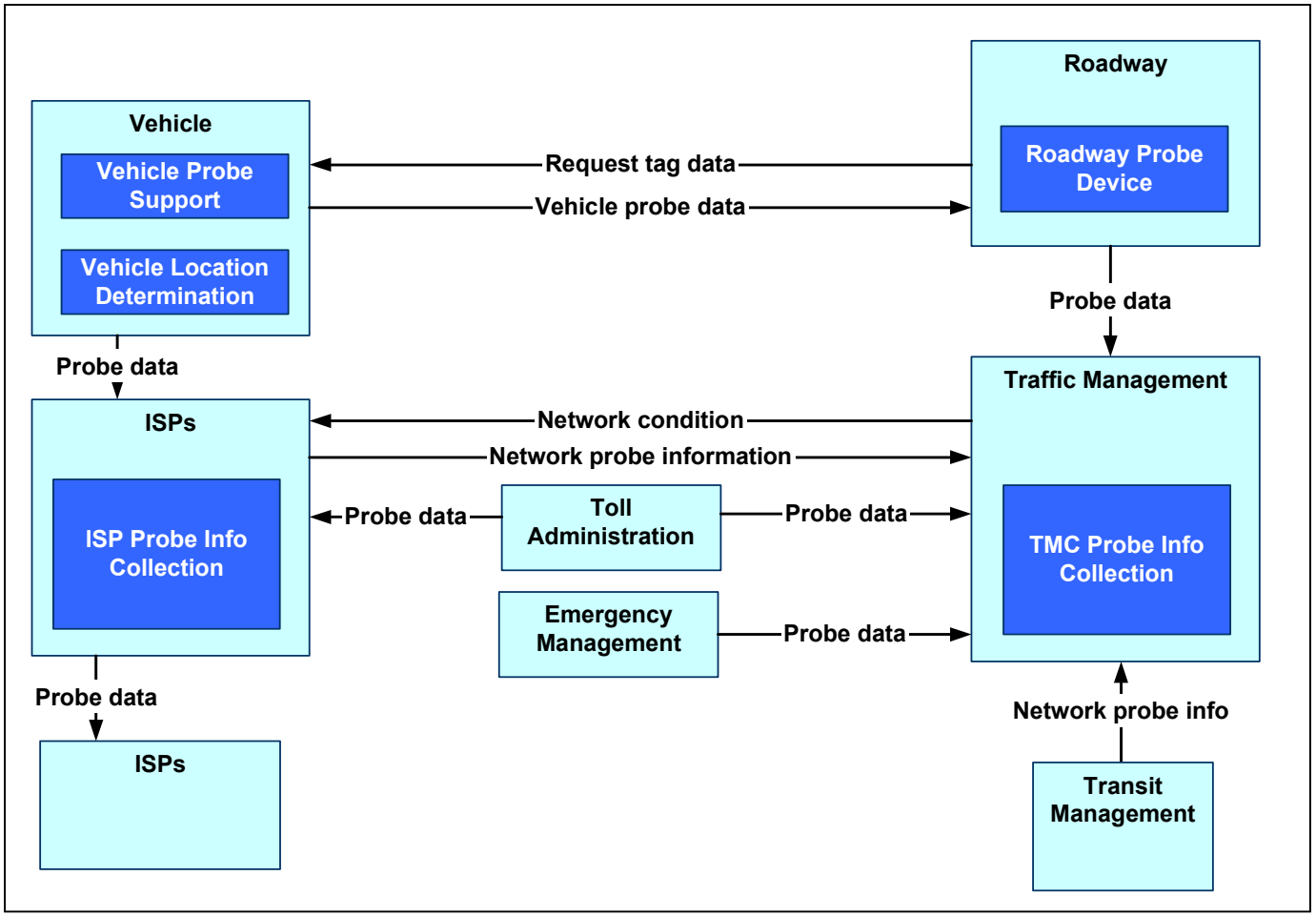

Figure 8-7: ATMS 2 – Probe Surveillance

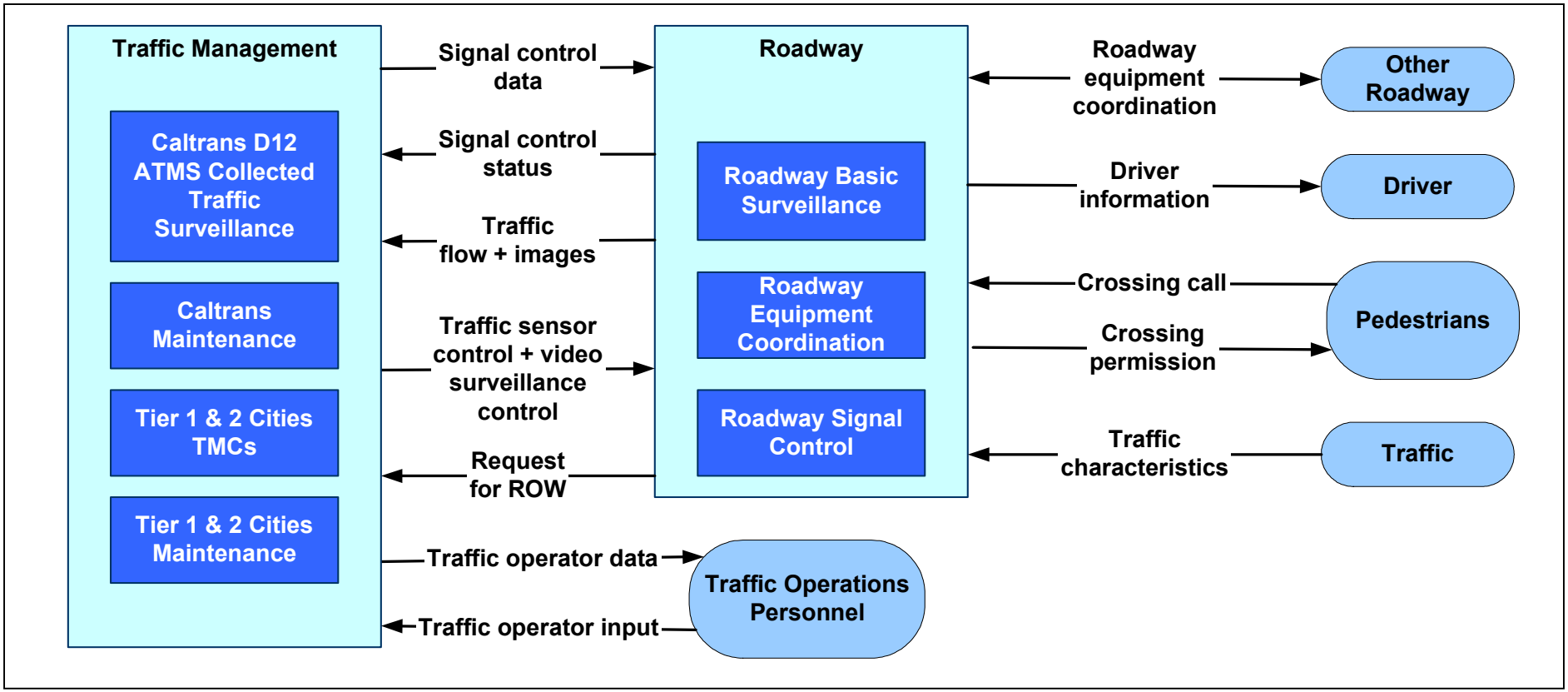

Figure 8-8: ATMS 3 – Surface Street Control

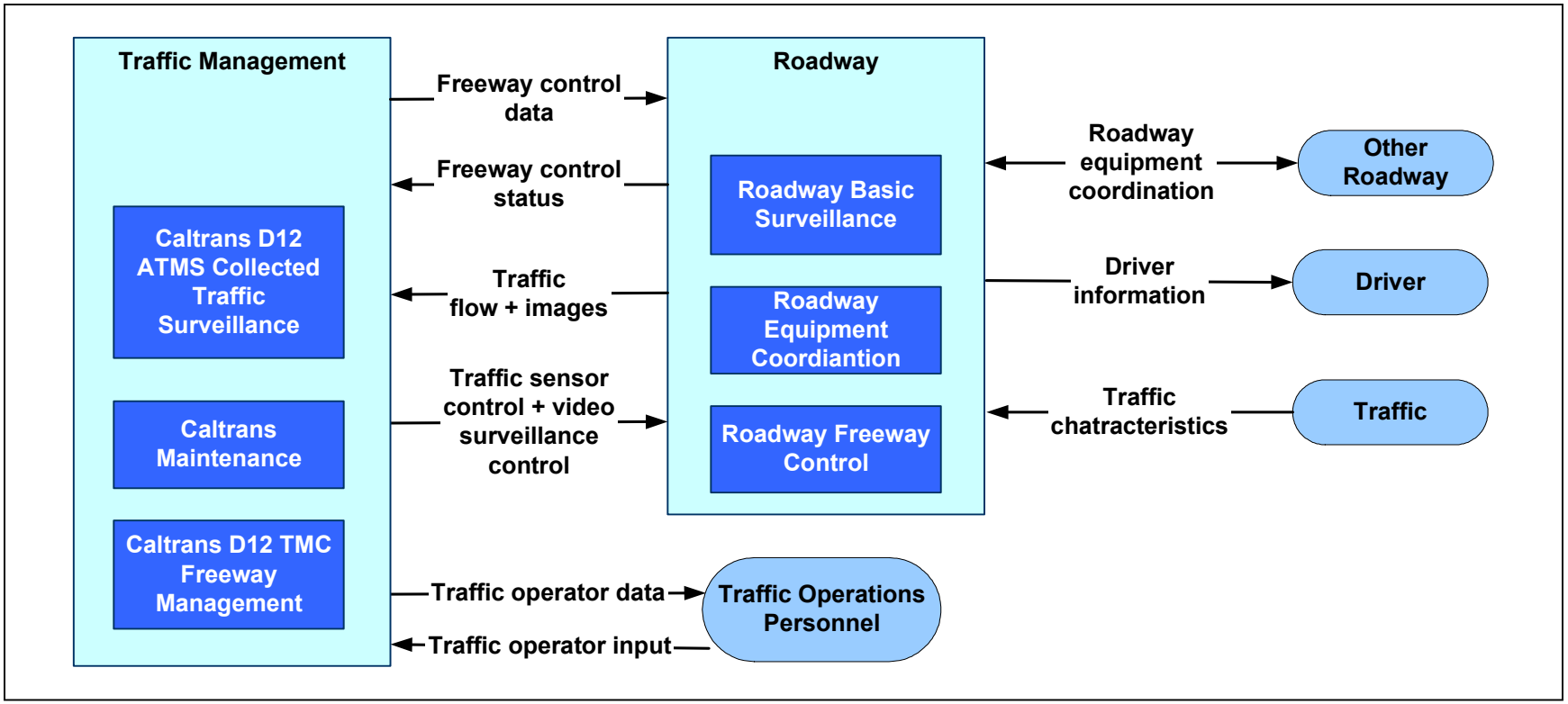

Figure 8-9: ATMS 4 – Freeway Control

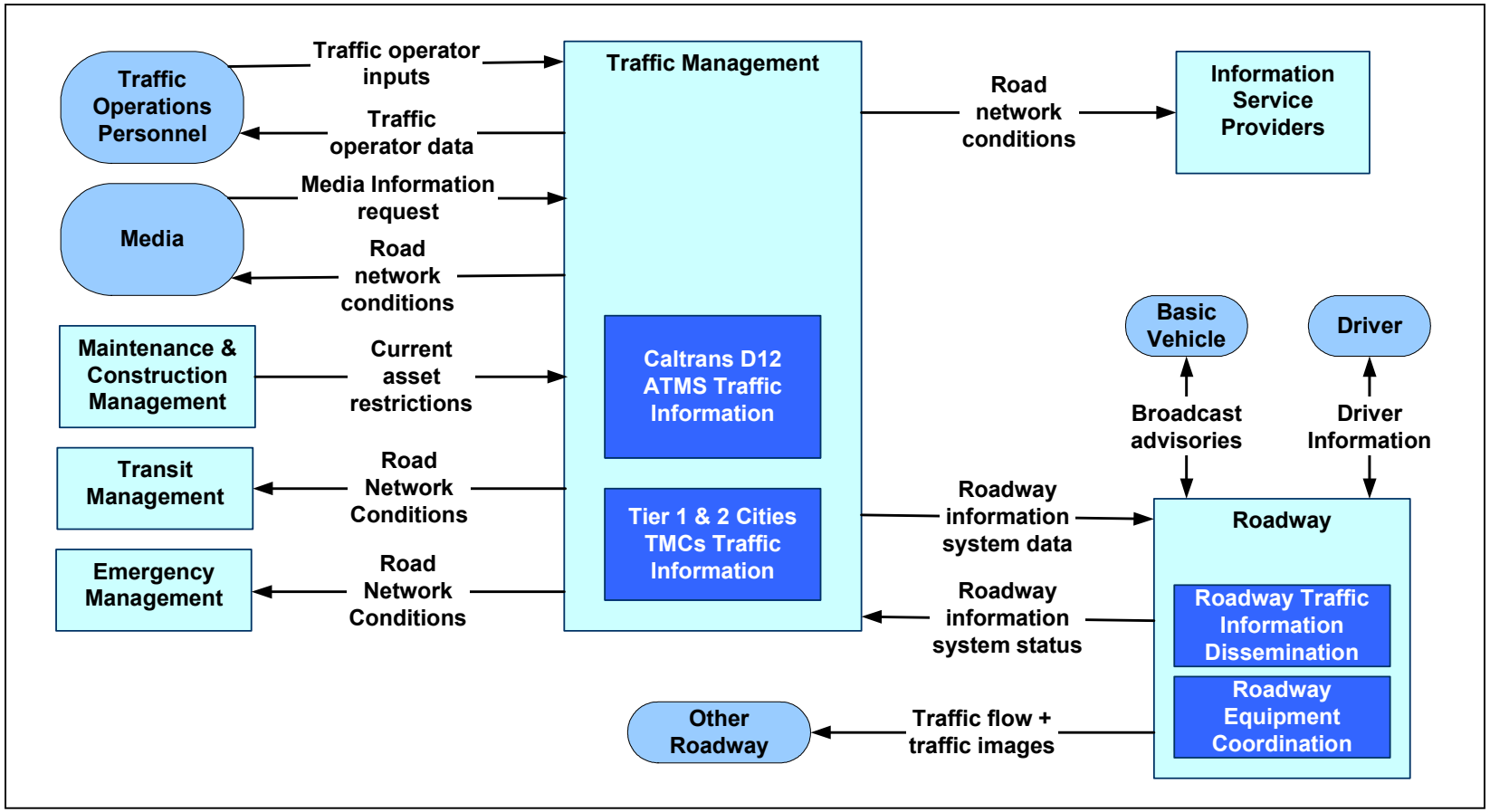

Figure 8-10: ATMS 6 –Traffic Information Dissemination

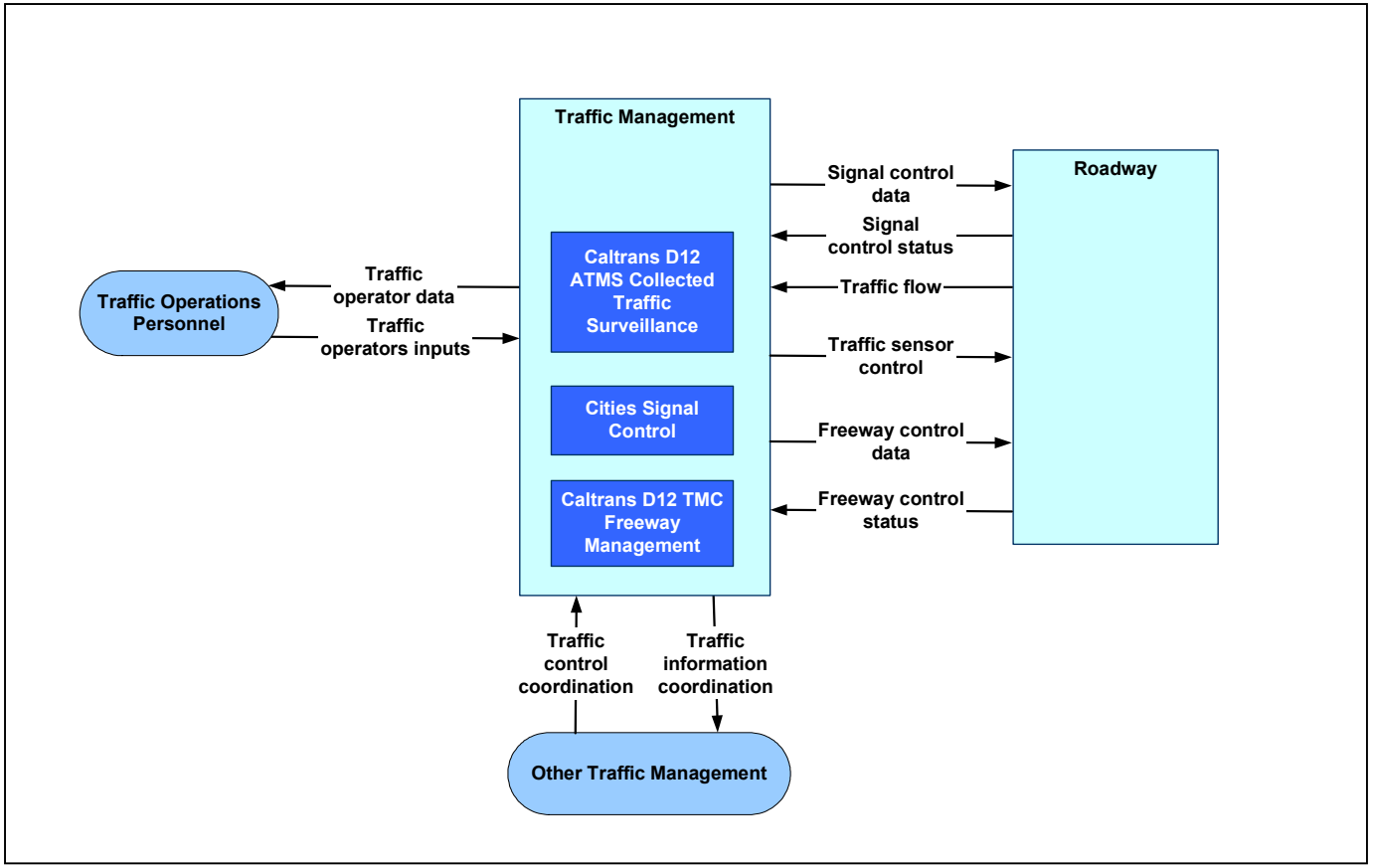

Figure 8-11: ATMS 7 – Regional Traffic Control

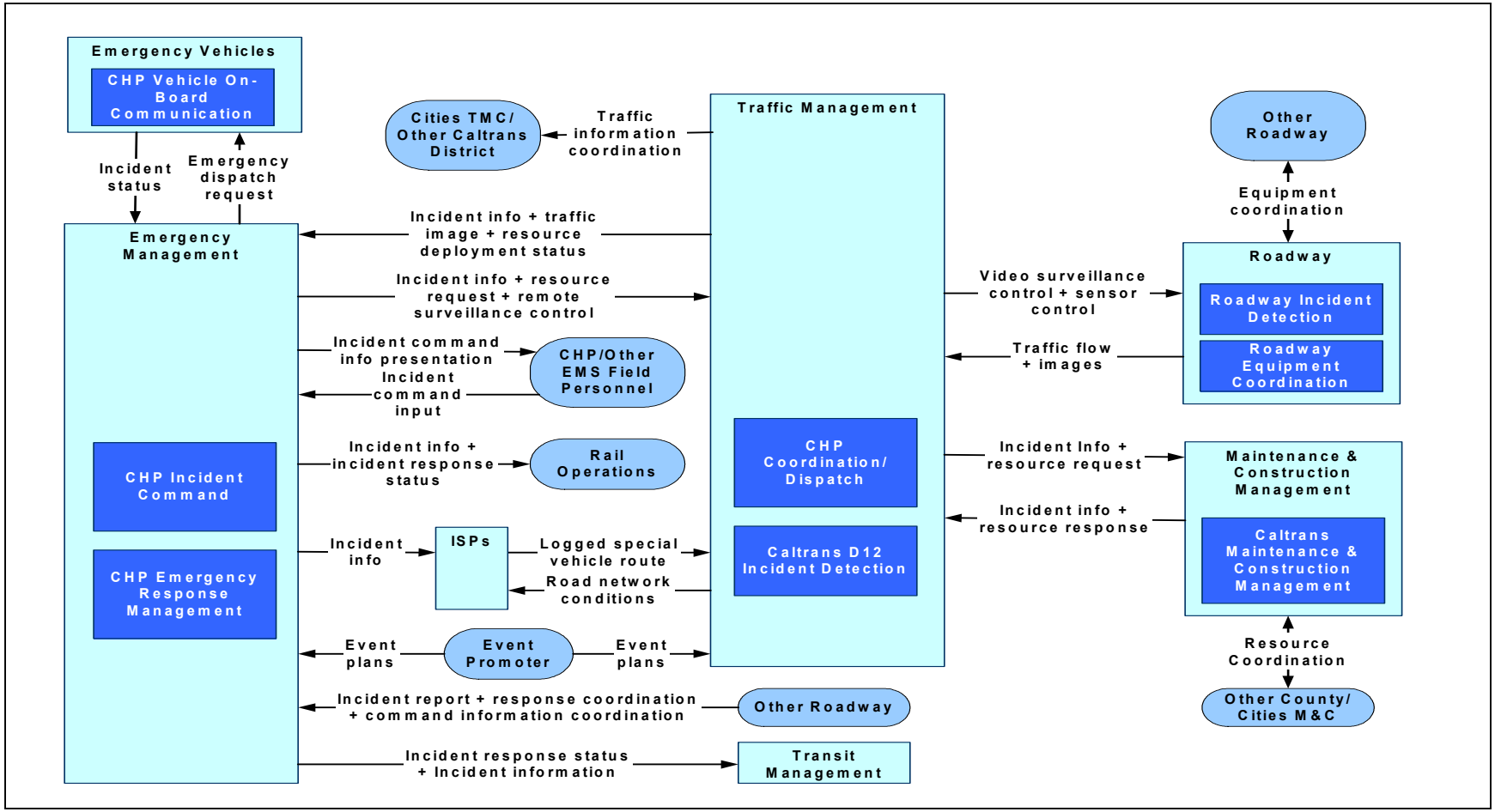

Figure 8-12: ATMS 8 – Traffic Incident Management System

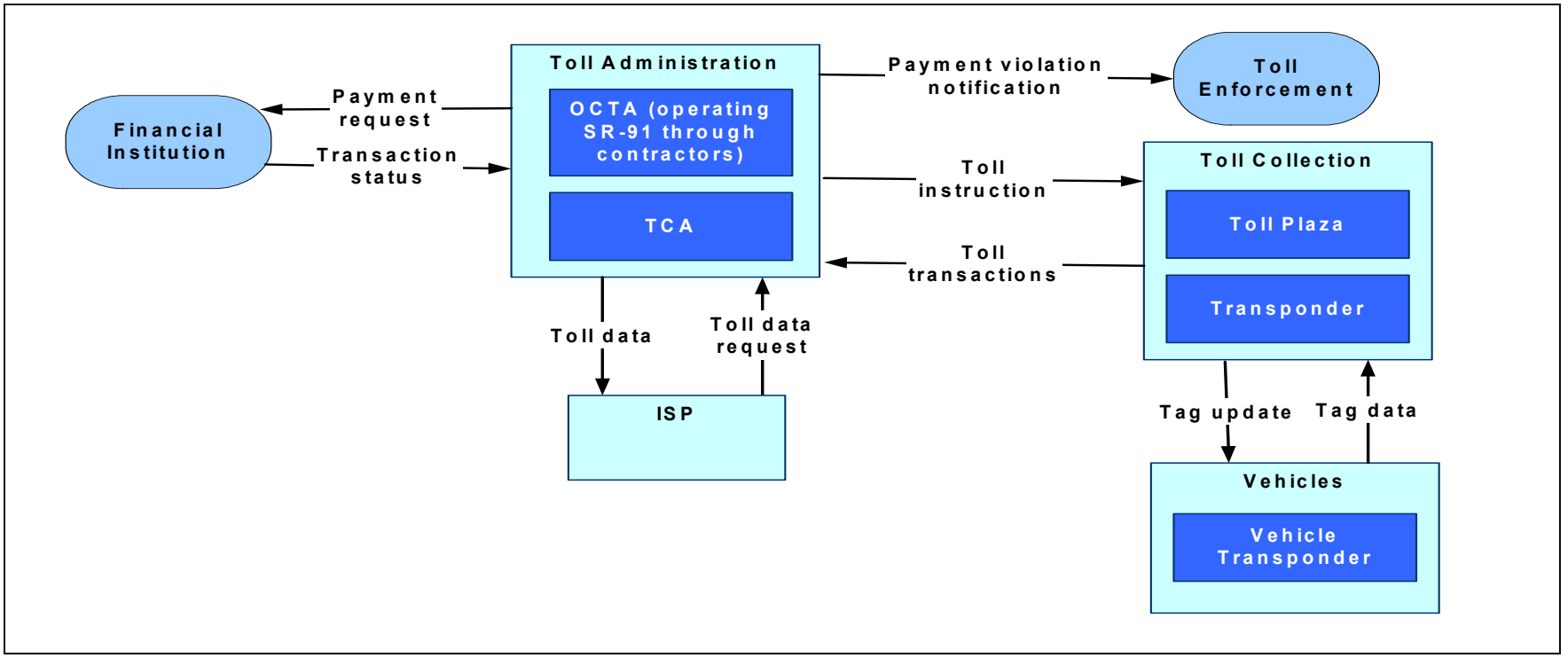

Figure 8-13: ATMS 10 – Electronic Toll Collection

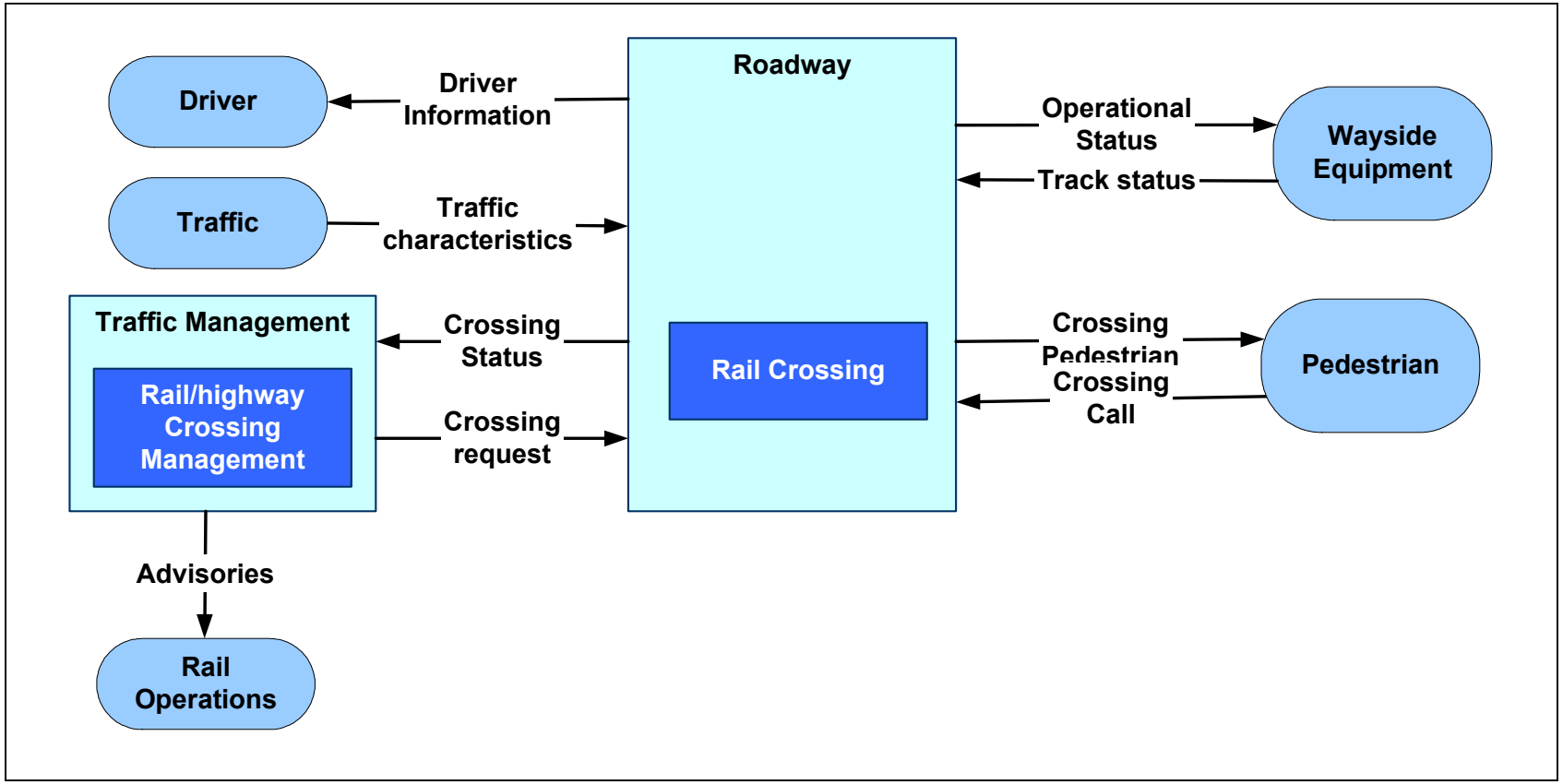

Figure 8-14: ATMS 13 – Standard Railroad Crossing

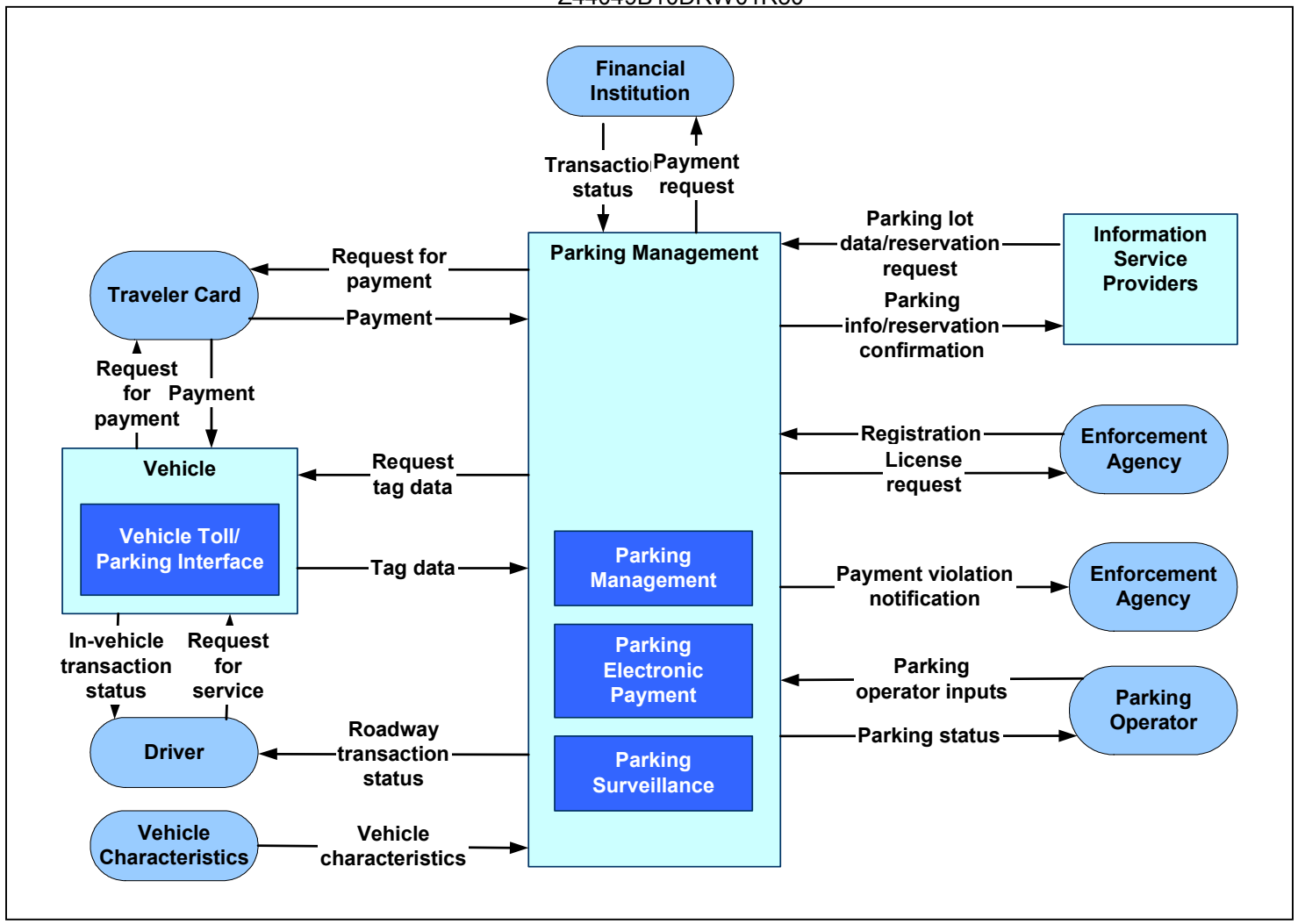

Figure 8-15: ATMS 16 – Parking Facility Management

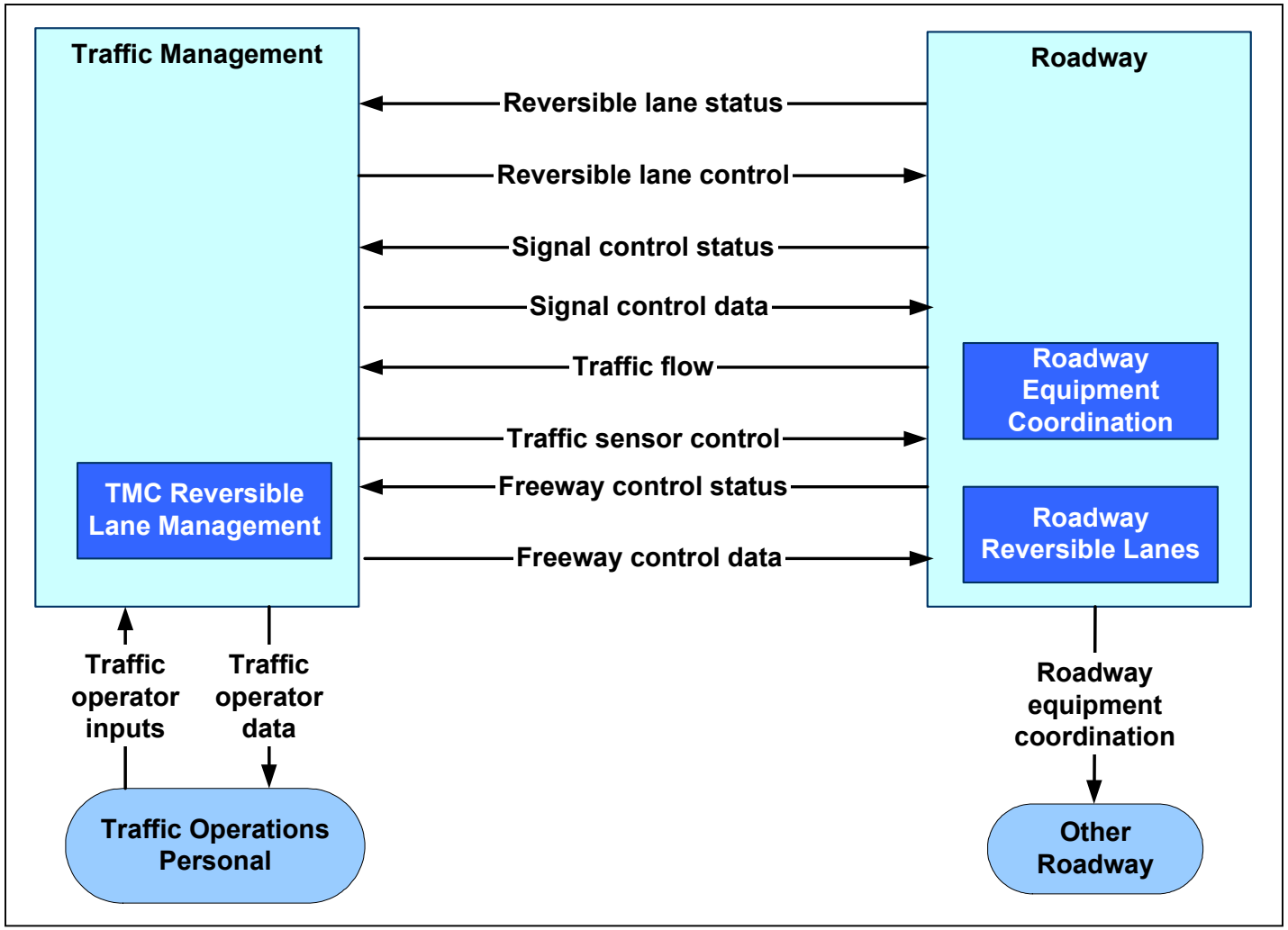

Figure 8-16: ATMS 18 – Reversible Lane Management

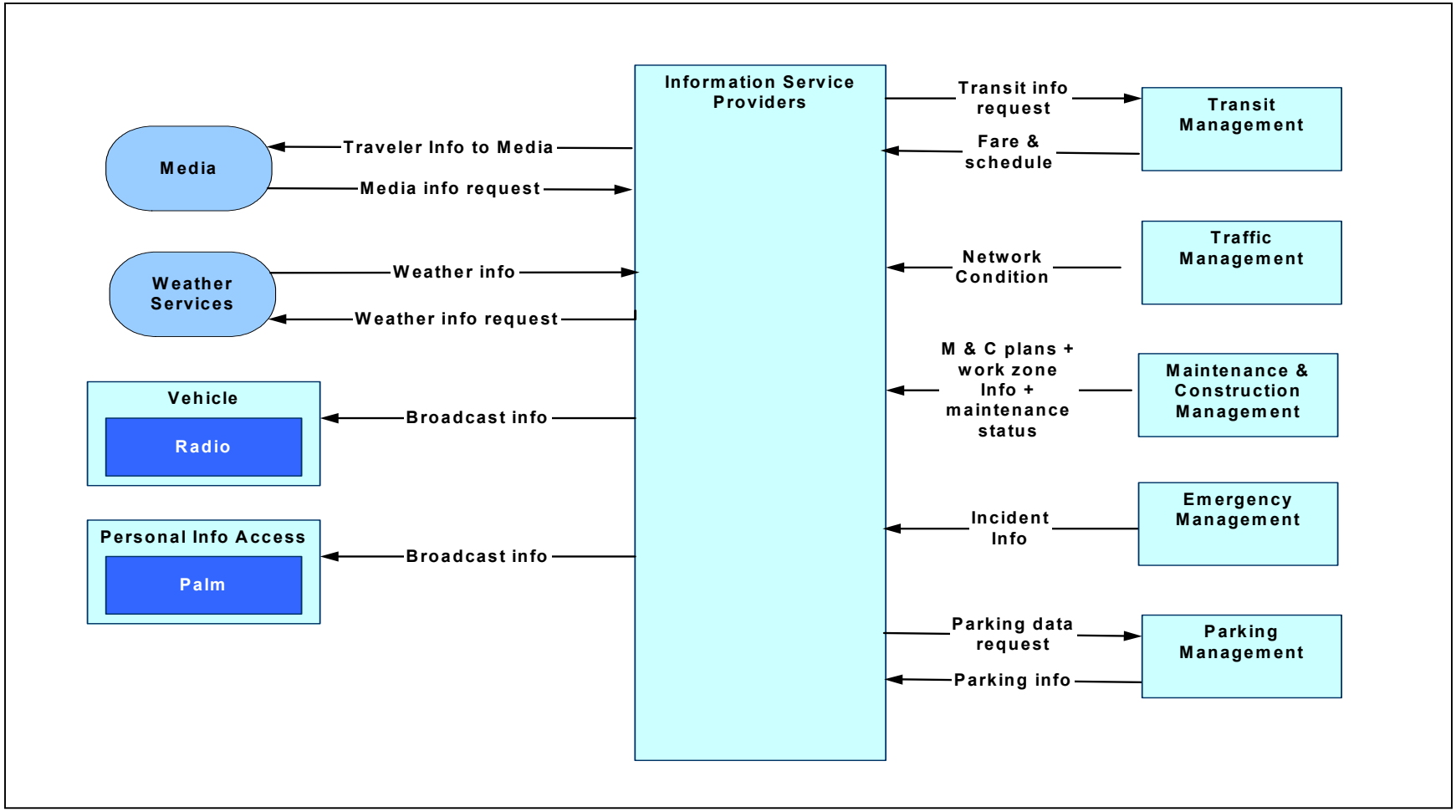

Figure 8-17: ATIS 1 – Broadcast Traveler Information

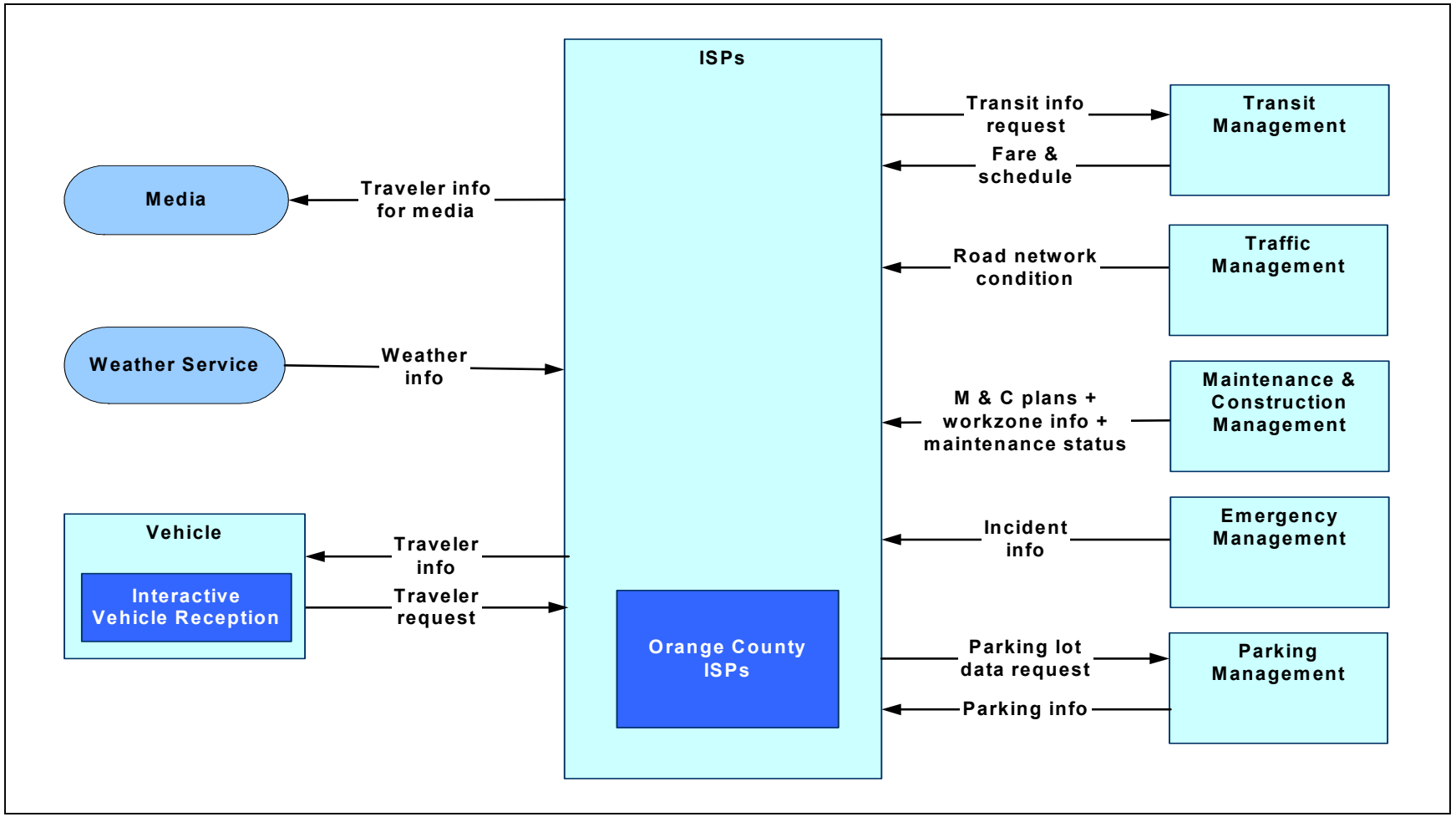

Figure 8-18: ATIS 2 – Interactive Traveler Information

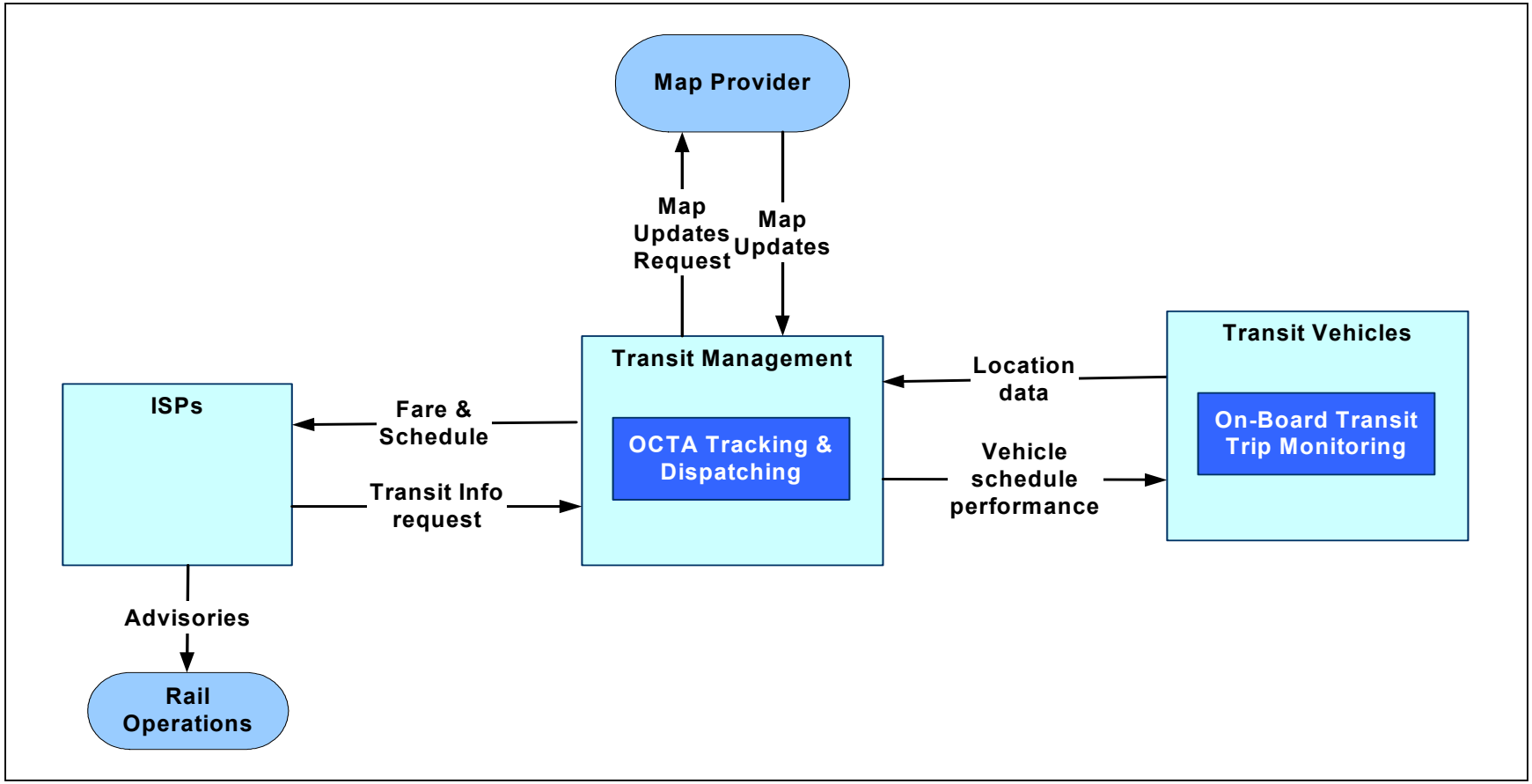

Figure 8-19: APTS 1 – Transit Vehicle Tracking

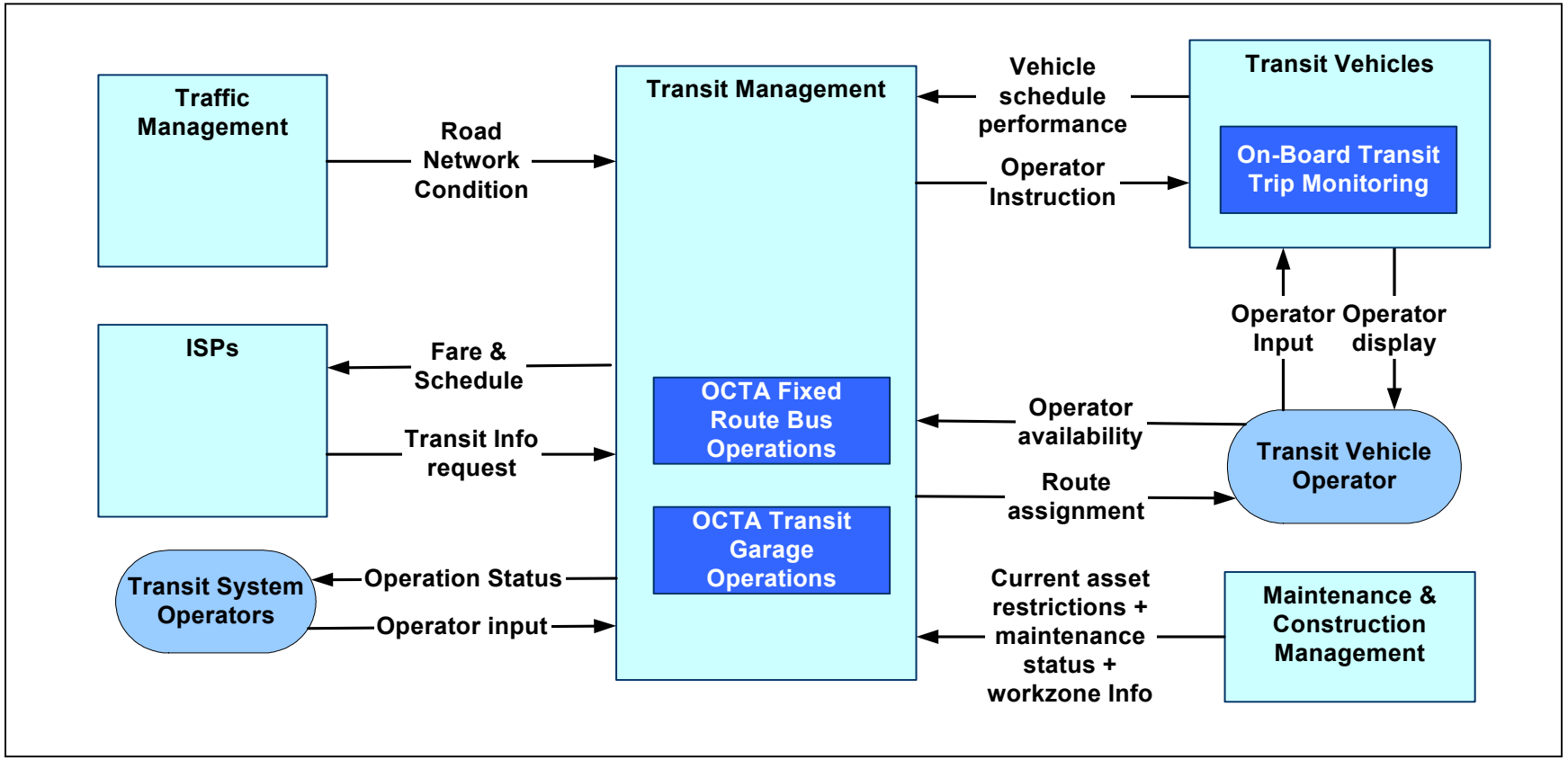

Figure 8-20: APTS 2 – Transit Fixed Route Operation

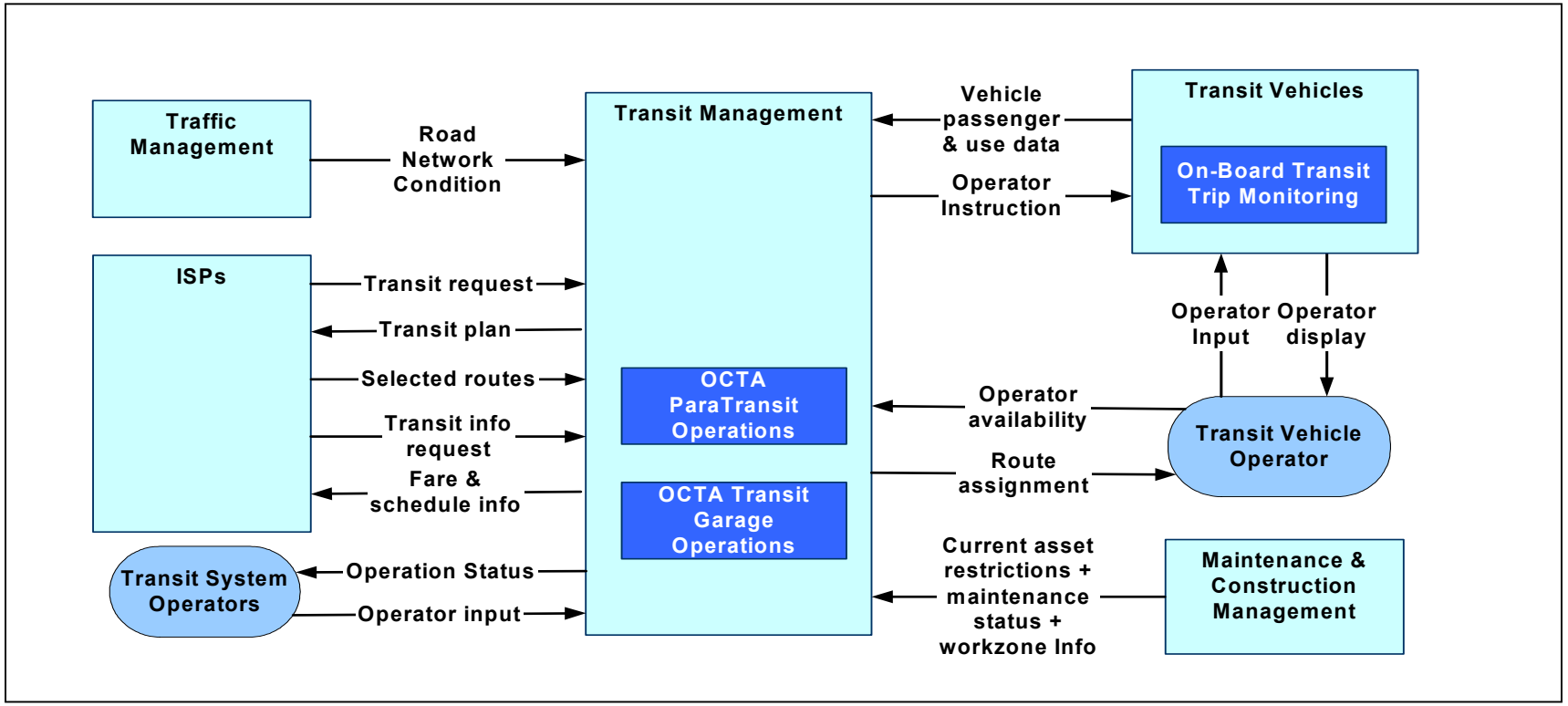

Figure 8-21: APTS 3 – Demand Response Transit Operation

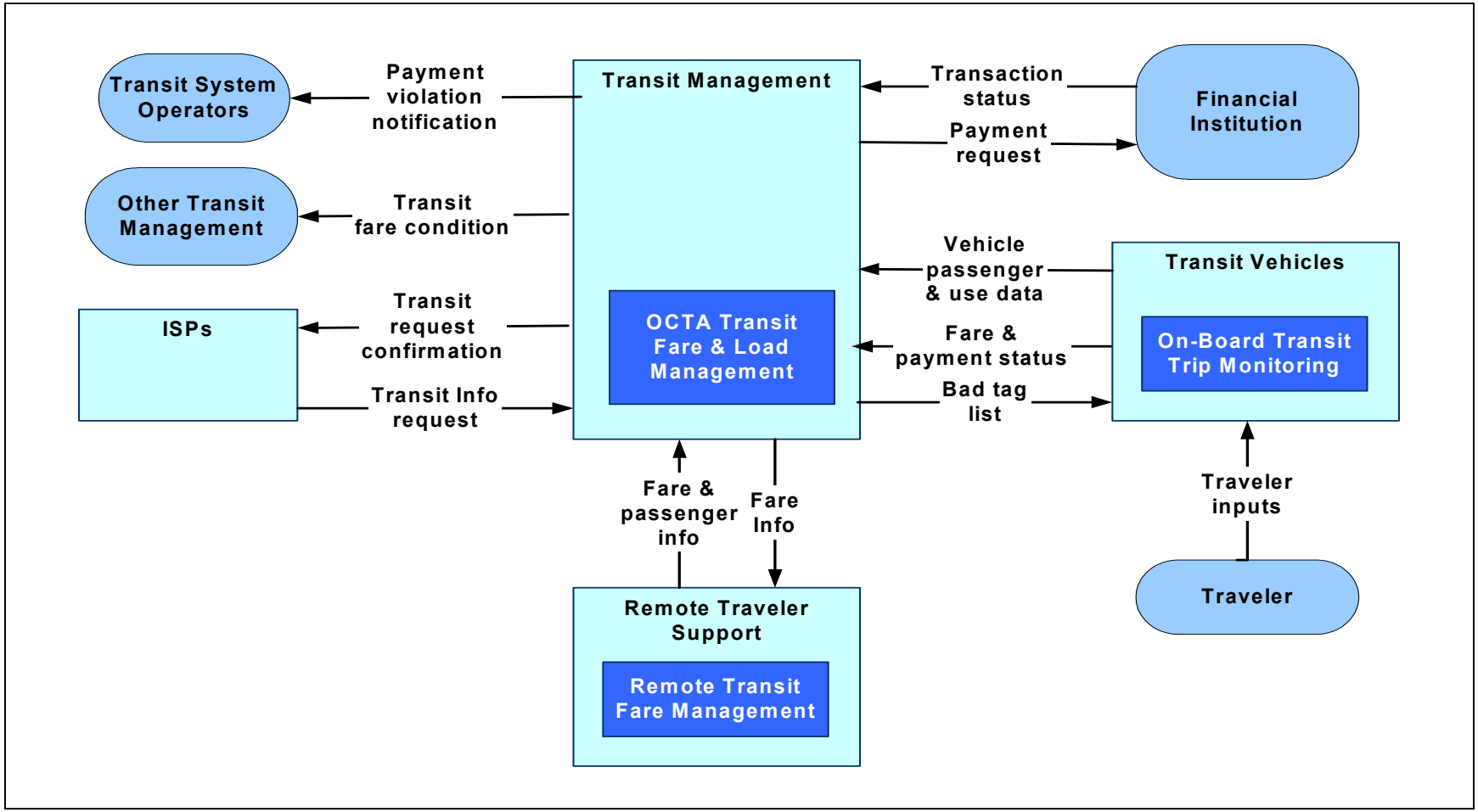

Figure 8-22: APTS 4 – Transit Passenger and Fare Management

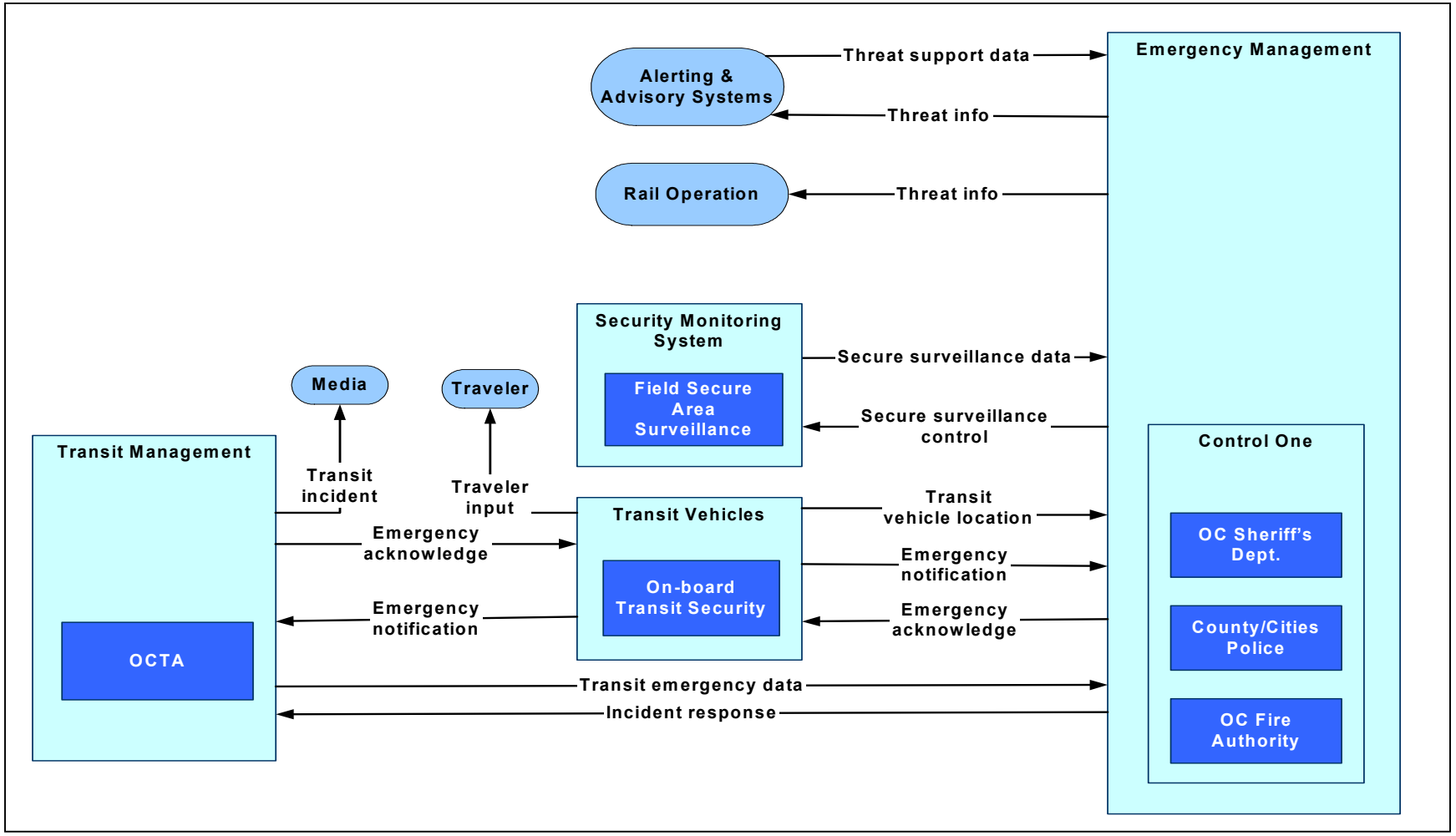

Figure 8-23: APTS 5 –Transit Security

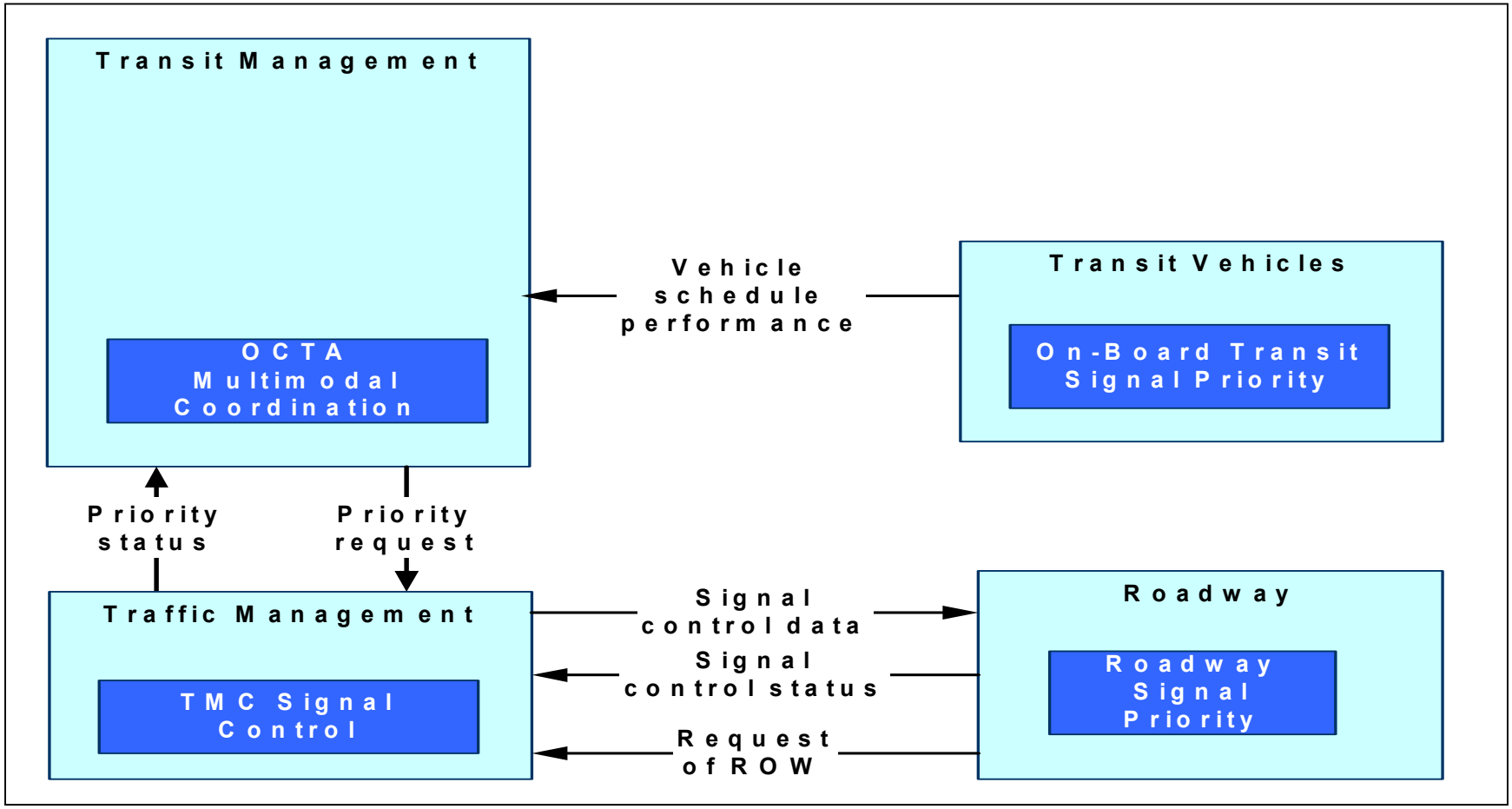

Figure 8-24: APTS 7— Multimodal Coordination

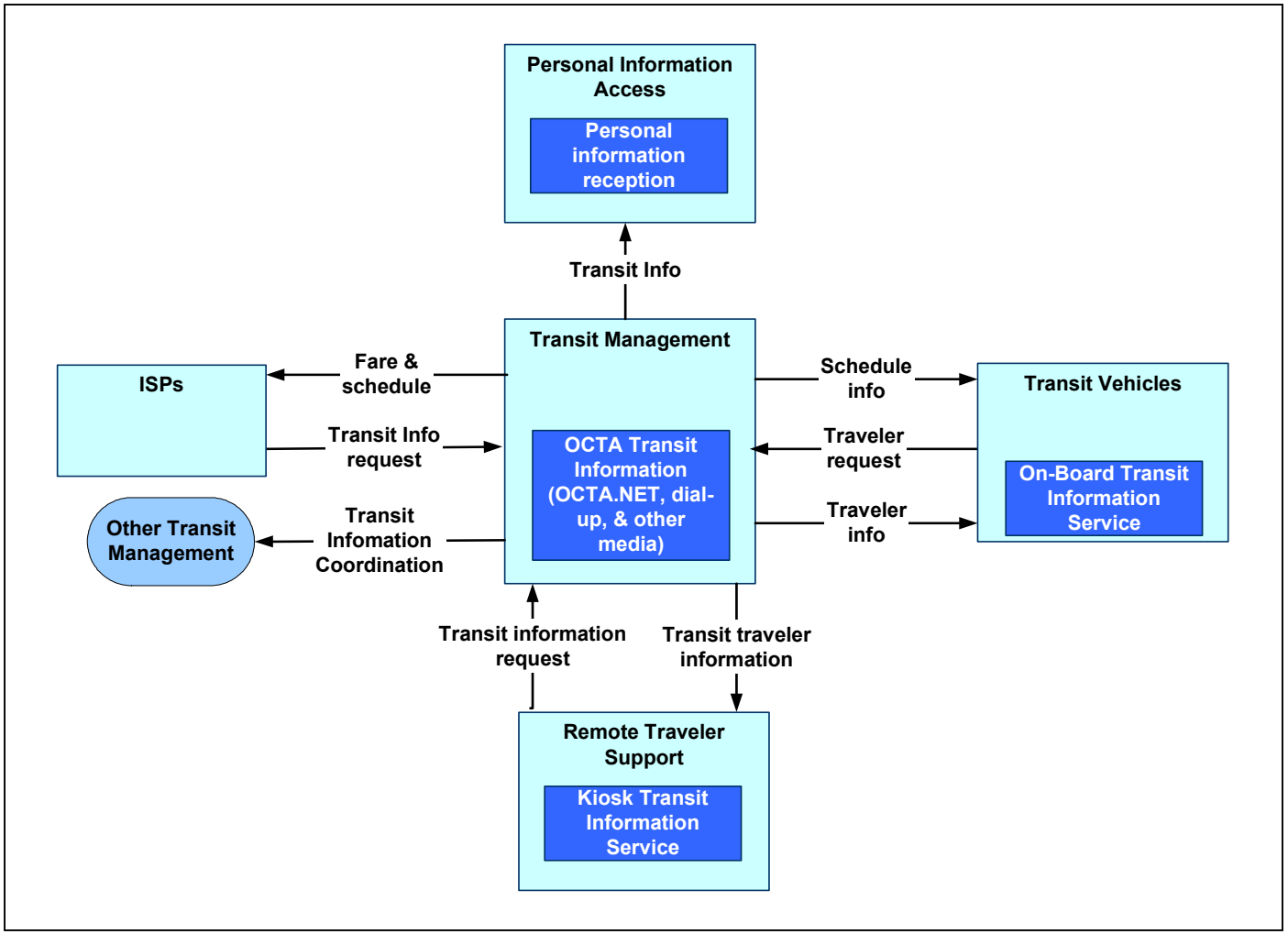

Figure 8-25: APTS 8 –Transit Traveler Information

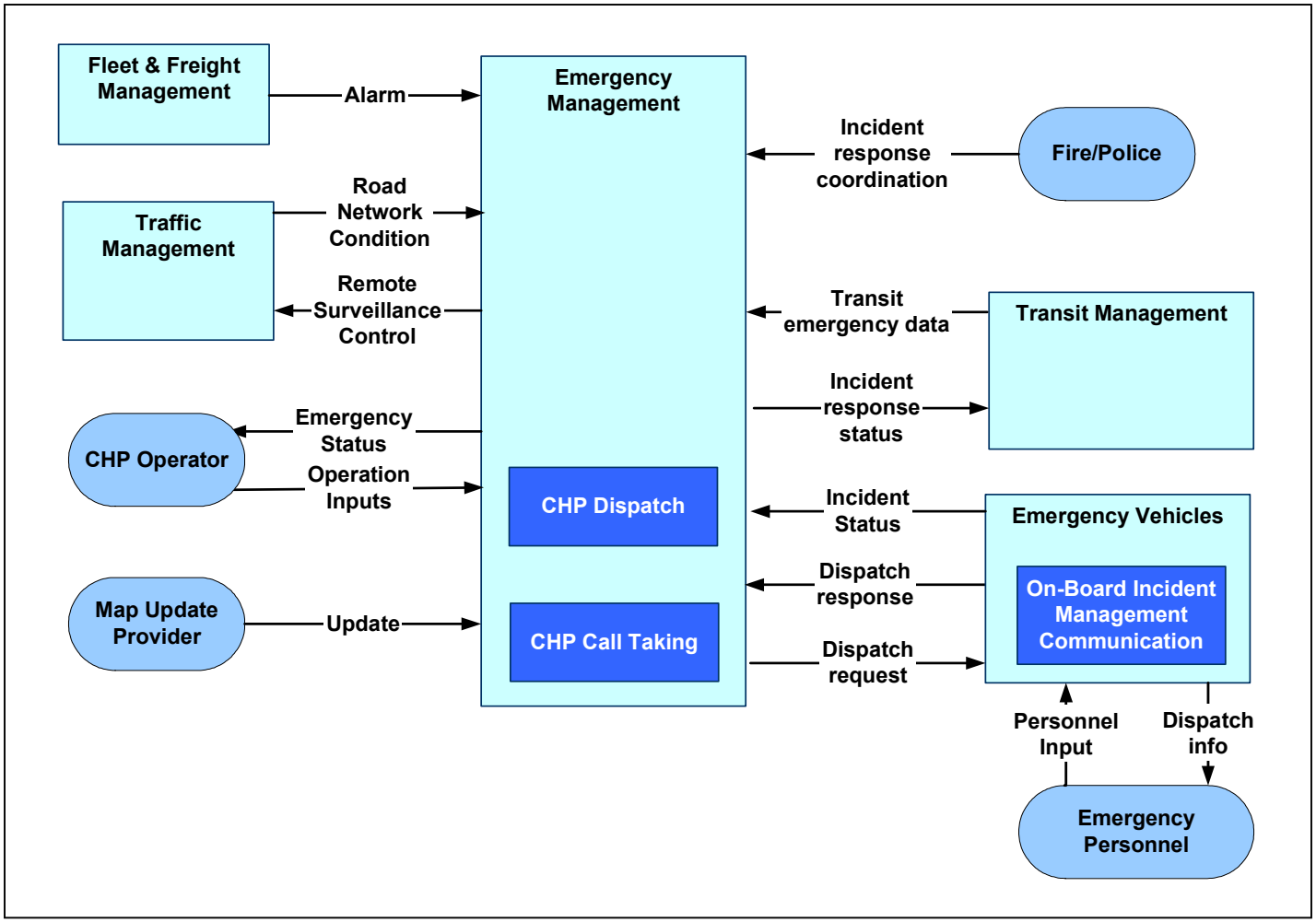

Figure 8-26: EM 1 – Emergency Call Taking and Dispatch

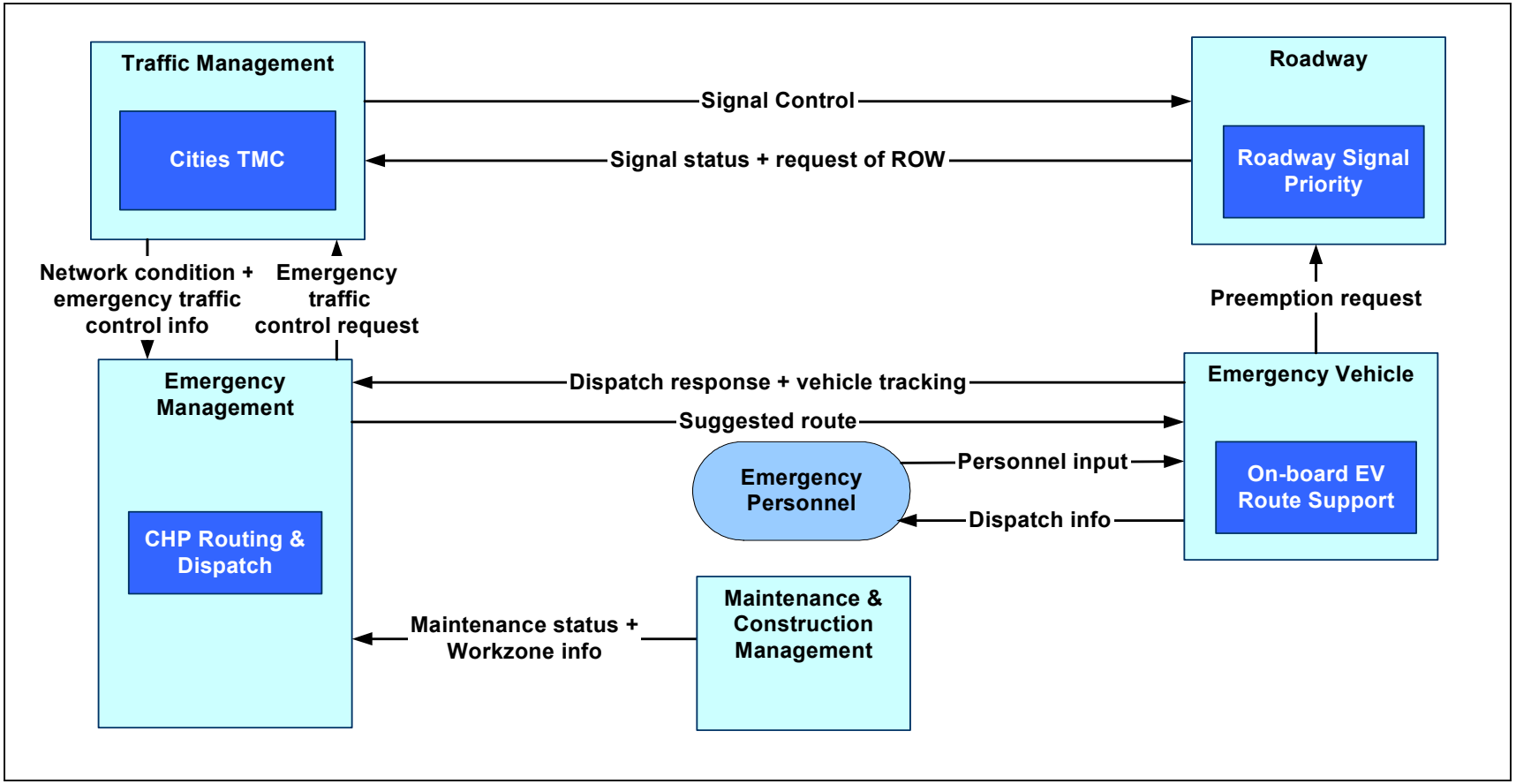

Figure 8-27: EM 2 – Emergency Routing

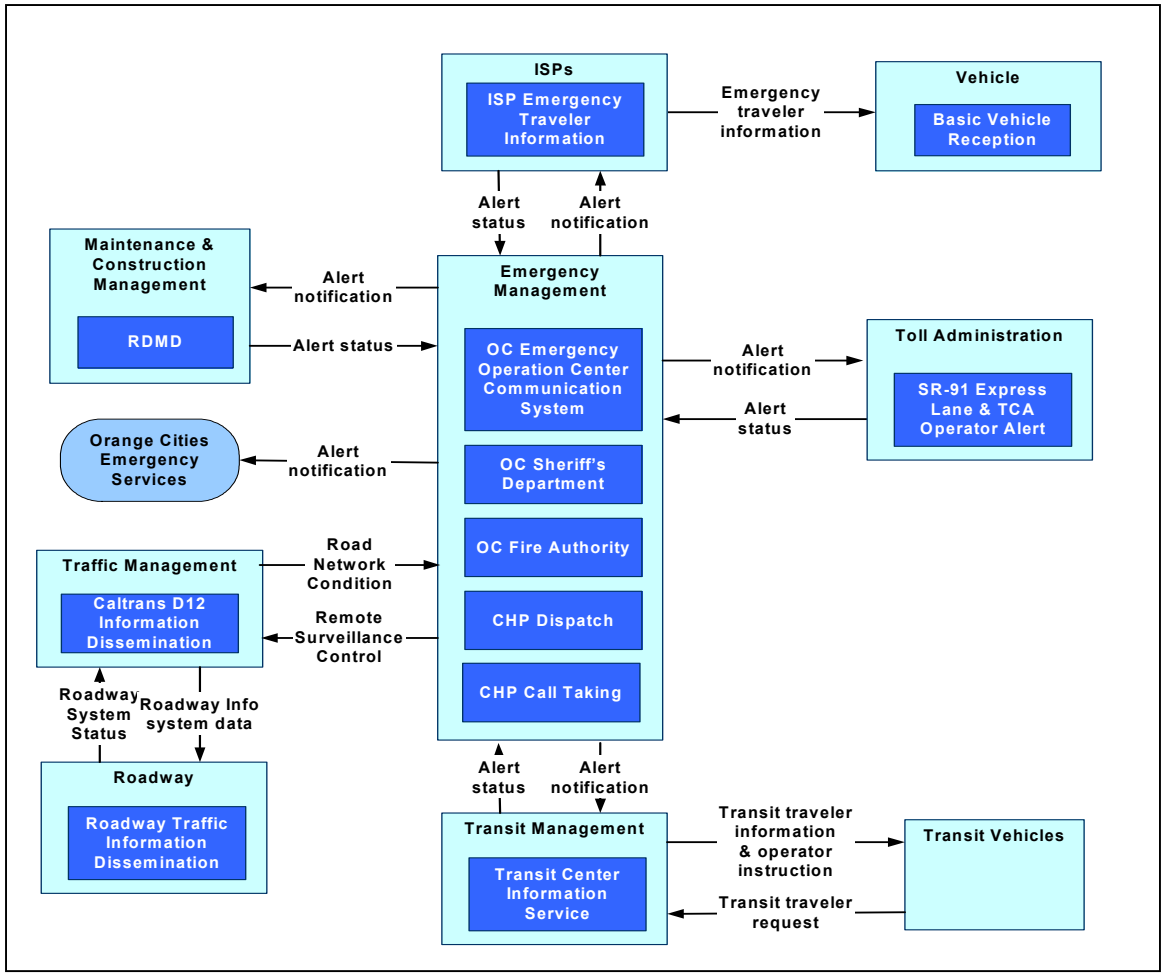

Figure 8-28: EM 6 – Wide Area Alert

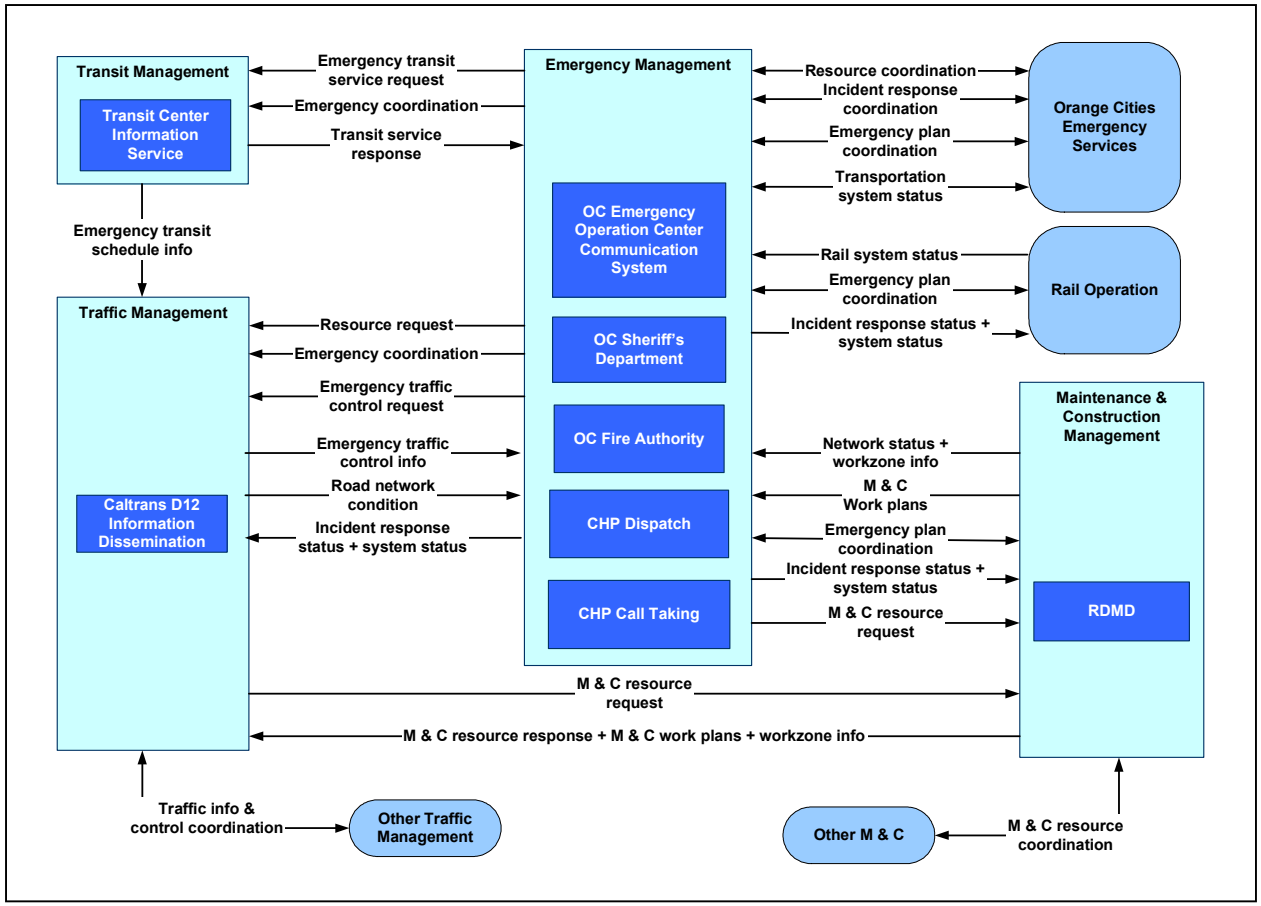

Figure 8-29: EM 8 – Disaster Response and Recovery

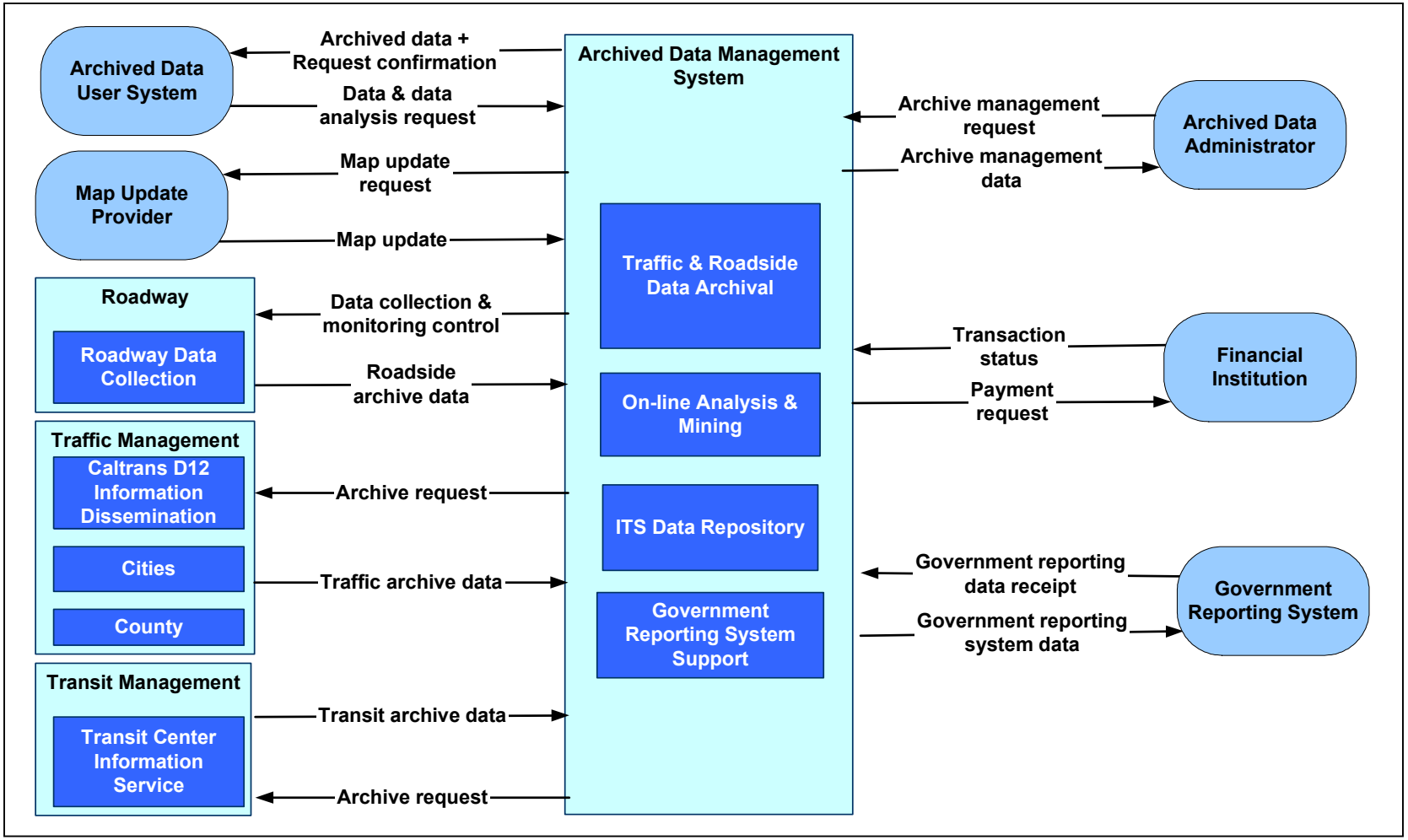

Figure 8-30: AD 2 – ITS Data Warehouse

9 Project Sequencing

The regional ITS architecture is implemented through many individual ITS projects that occur over years, or even decades. In this step of the Regional ITS architecture development, a sequence, or ordering of ITS projects that will contribute to the integrated regional transportation system is identified.

An ITS projects is defined by FHWA as “Any project that in whole or in part funds the acquisition of technologies or systems of technologies that provide or significantly contribute to the provision of one or more ITS user services as defined in the National Architecture.”

The FHWA Regional ITS Guidance Document also refers to project sequencing as representing consensus building about setting priorities that show how ITS projects can build one upon another. In an advanced and institutionally complex County, such as Orange County, where many systems have already been deployed, no one agency or group of agencies sets priorities.

The sequence of anticipated projects depicted in Table 9-1 was assembled through the following means:

- Surveys
- Interviews conducted by the project team
- Workshops carried out specifically to collect views, issues, needs, and project plans.

All projects are listed irrespective of whether or not they might be funded through federal sources. Known listed projects are identified first with specific named Stakeholders. This is then followed by more generic categories of projects, which can be anticipated in the future.

As a reflection of the relative maturity of ITS projects in Orange County it will be noted that many of the projects are oriented towards upgrades, additions and improvements to field and TOC equipment. There are also projects that pursue multi-agency coordination of signal systems involving the creation of new software interfaces and the exchange of multi-agency camera images. Through these types of projects the first elements of a future regional network are potentially being created.

Table 9-1: Orange County Project Sequencing

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
City of Brea Signal Replacement	ATMS 3: Surface Street Control	City of Brea	Brea is planning to replace its entire signal system. It will replace the Multisonics system with a yet-to-be-determined type. It will involve new master and compatible intersection controllers. The project will be funded with GMA funds.	S
Costa Mesa Signal/CCTV Communication Project	ATMS 3: Surface Street Control	City of Costa Mesa	Installation of fiber cable expanding existing fiber system, converting CCTV cameras to fiber communications, installation of communications cabinets and signal modifications at two locations.	S
Costa Mesa Signal System Management Project	ATMS 3: Surface Street Control	City of Costa Mesa	Develop ATMS/GUI Front-End for the VMS 330 signal system, integration with the Santa Ana signal system and the Caltrans BiTrans QuicNet system, via NTCIP open architecture.	S
Bear Street Signal Improvement	ATMS 3: Surface Street Control	City of Costa Mesa	Communications interface upgrades between Caltrans and City signal controllers, modification of two traffic signals, and signal coordination	S
OC Fairground CCTV/CMS Improvement	ATMS 3: Surface Street Control	City of Costa Mesa	Furnishing CCTV and CMS at two locations for ongoing events at the OC Fairgrounds, including joint agency control provisions.	S
Costa Mesa/Santa Ana Signal Coordination	ATMS 3: Surface Street Control	Cities of Costa Mesa & Santa Ana	Development of signal coordination upgrades along seven joint agency arterials.	S/M
Caltrans TMC/Costa Mesa TOC CCTV System Interface	ATMS 3: Surface Street Control	City of Costa Mesa	Enhancing the existing fiber link with Caltrans to enable full CCTV operability between agencies.	L

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
Costa Mesa Trail Blazer Signs	ATIS 4 Dynamic Route Guidance	City of Costa Mesa	Provisions for transportable trail blazer informational signs to accommodate various OC Fairgrounds event demands.	S
Costa Mesa Emergency Services/TOC Integration	ATMS 8: Traffic Incident Management System EM 1: Emergency Call Taking and Dispatch EM 2: Emergency Routing	City of Costa Mesa	Enhanced interface provisions between Police, Fire, Emergency Services and the TOC pertaining to traffic conditions, incidents and emergency response. Includes sharing of CCTV, establishing special signal coordination programs and strategies for various emergency response scenarios, expanded data exchange, video conferencing, and protocol development.	M
TMC Renovation Project	ATMS 3: Surface Street Control	City of Anaheim	City of Anaheim plans to upgrade TMC media wall, console and network equipment	S
Costa Mesa Fiber Optic Integration with TOC	ATMS 3: Surface Street Control	City of Costa Mesa	15 miles of fiber optic traffic signal interconnects for signals and CCTV cameras on several major streets, and connecting to City's TMC. Funding budgeted. Estimated completion by Fall of 2005. 1.5 miles of fiber optic traffic signal interconnect within existing conduit and CCTV lines surrounding The Block shopping center. Funding provided by developers. Expected completion by end of 2006.	S

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
The Block Signal Fiber Interconnect	ATMS 3: Surface Street Control	City of Orange	Approximately 1.5 miles of fiber optic traffic signal interconnect within existing conduit and CCTV lines surrounding The Block shopping center in West Orange. Funding provided by developers, not yet in hand. Expected completion by the end of 2006.	S
East Orange Fiber Interconnect	ATMS 3: Surface Street Control	City of Orange	Approximately 4 miles of fiber optic traffic signal interconnect and CCTV lines in the East Orange area. Expected grant and developer funding. Estimated completion by 2007. Approximately 4 miles of fiber optic traffic signal interconnect and CCTV lines in the East Orange County area. Expected grant and developer funding. Estimated completion by 2007.	S
Expansion of Cypress CCTV System	ATMS 3: Surface Street Control	City of Cypress	The installation of an additional 14 CCTV cameras into the City's existing CCTV system.	S
Retiming of Interconnected Traffic Signals on Arterial Grid Network	ATMS 3: Surface Street Control	City of Cypress	Study and retiming of the City's 41 interconnected traffic signals	S
Garden Grove TMC Upgrade	ATMS 3: Surface Street Control	City of Garden Grove	Upgrade the City's TMC to enhanced software, allowing for direct control of traffic signals. Estimated completion by Summer, 2005.	S

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
Garden Grove TMC Link to Field Signals	ATMS 3: Surface Street Control	City of Garden Grove	Fielding of IP-based fiber communications links from TMC to traffic signals in field for several locations.	S
Anaheim TMCs Integration	ATMS 3: Surface Street Control	City of Anaheim and its surrounding cities	Possible integration with City of Anaheim TMC within next several years, cost unknown, potential grant application.	L
Remote TMC & Traveler Info Center	ATMS 3: Surface Street Control ATIS 2: Interactive Traveler Information	City of Mission Viejo	The proposed "Remote TMC Facility and Traveler/Public Information Access Center" project consists of design of the facility, implementation/construction, and integration of the remote TMC workstations into the expanded library along with other ongoing ITS projects in the city. The proposed remote TMC facility will augment the existing TMC (at present located in a leased office building and will be moved once the new city hall is built) operation.	S
Laguna Woods City Wide Signal Control, Interconnect, and Surveillance System	ATMS 3: Surface Street Control	City of Laguna Woods	Will install new traffic signal controllers, cabinets, and Econolite Aries master system. It began in Jan 2005. Installation of traffic signal interconnects conduit and cable on several major streets. It will connect to Laguna Hills and Laguna Beach. Currently underway.	S
Laguna Woods Emergency Vehicle Preemption (EVP)	ATMS 3: Surface Street Control	City of Laguna Woods	Install EVP at 11 intersections.	S

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
El Toro Rd Interconnect	ATMS 3: Surface Street Control	City of Lake Forest	El Toro Road Interconnect Install twisted pair and fiber optic interconnect from Bridger to Serrano and controllers from Bridger to Raymond	S
Portola Parkway Interconnect	ATMS 3: Surface Street Control	City of Lake Forest	Portola Parkway Interconnect Install twisted pair interconnect from Alton to El Toro Road	S
Lake Forest Signal Preemption Installation	ATMS 3: Surface Street Control	City of Lake Forest	Traffic Signal Pre-emption Install EVP at 32 intersections	S
Buena Park Signal Upgrade	ATMS 3: Surface Street Control	City of Buena Park	Upgrading and coordinating signals on the 5 major arterials in Buena Park including other ITS features like CCTV cameras, count stations, traffic responsive self adjusting signal timing, fiber optic interconnect, etc.	S
Buena Park I-5 Widening Management	MC 8: Work Zone Management ATMS 6: Traffic Information Dissemination	City of Buena Park	A commercial vehicle grant to install DMS and a traveler information website for trucks during and after the I-5 widening project. It will also link the City to IEN Network and the other 5 JPA cities, Cypress, Fullerton, Anaheim and Caltrans District 12 and D7.	M
Buena Park Integration	ATMS 3: Surface Street Control	City of Buena Park	The City will be applying for 7 projects from the CTFP call for projects, one notably will be coordination along Lincoln between Anaheim and Cypress across Buena Park	M

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
West Garden Grove Signal Intertie	ATMS 3: Surface Street Control	City of Garden Grove	The project will include 2 Changeable Message signs, one on Harbor Blvd. north of SR-22 and one on Valley View Street north of SR-22. The project will also include installing fiber optic cable down Chapman Avenue from Valley View Street to Magnolia Street and then into our existing conduit system back to the City Hall TMC. A total of approximately 3.5 miles of fiber will be installed.	S
Newport Beach Signal System Upgrade	ATMS 3: Surface Street Control	City of Newport Beach	Upgrade the existing signal system, controllers and communication network. Acquire new central traffic signal control system to replace VMS 330. Replace existing 820A signal controllers. Install fiber optic communications infrastructure.	S
Westminster CCTV and Video Detection	ATMS 3: Surface Street Control	City of Westminster	Install CCTV and Video Detection cameras throughout the city. Fiber optic cable will be installed to facilitate the video feed back to City Hall.	S
Westminster Traffic Signal System Field Element Upgrade	ATMS 3: Surface Street Control	City of Westminster	The project has 5 phases 1) Upgrade traffic signal controllers to be capable of inter-regional data sharing. 2) Provide GUI hardware and software in support of congestion and incident management. 3) Augment existing fiber-optic communication interconnect system by completing the eastern half of the system. 4) Augment the City's existing fiber-optic communication interconnect system by completing the western half of the system. 5) Upgrade traffic signal controllers, which will then be capable of inter-regional data sharing throughout the city.	M

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
Fountain Valley CCTV Installation and TMC Expansion	ATMS 3: Surface Street Control	City of Fountain Valley	23 CCTV cameras and TMC expansion along with 2070 controllers throughout the city.	S
Huntington Beach Fiber Optic Integration	ATMS 3: Surface Street Control	City of Huntington Beach	Federally funded fiber optic communications project for system integration, which would link cameras on PCH, Fountain Valley, Westminster, and Caltrans TMC.	S
Signal Maintenance & Coordination Study	ATMS 3: Surface Street Control	OCTA Cities	To analyze & suggest solutions to interagency signal coordination or priority corridors.	S
Bus Rapid Transit	APTS 2: Transit Fix Route Operation	OCTA Cities	Would involve multiple solutions, including potential signal priority & other transit management technologies.	M
Continued APTS equipment on OCTA fleet	APTS 1: Transit Vehicle Tracking	OCTA	Continued outfitting of new buses with AVL & other APTS equipment.	S
Orange City System Integration	ATMS 3: Surface Street Control ATMS 7: Regional Traffic Control	City of Orange	Complete full GIS integration in 2005; Extend fiber for new residential homes; Fiber project to connect City Hall to the corporate yard.	S

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
Orange City Signal Interconnect	ATMS 3: Surface Street Control	City of Orange	Approximately 15 miles of fiber optic traffic signal interconnect for signals and CCTV cameras on Main Street, Chapman Avenue, Tustin Avenue and Katella Street, connecting to City's Traffic Management Center (TMC), at a total cost of about $2 million. Funding budgeted. Estimated completion by Fall of 2005.	S
Orange City TMC Upgrade	ATMS 3: Surface Street Control	City of Orange	Upgrade of City's Traffic Management Center to enhanced software, allowing for direct control of traffic signals, at a cost of $85,000. Funding budgeted. Estimated completion by Summer, 2005.	S
Orange City TMC Link to Field Signals	ATMS 3: Surface Street Control	City of Orange	Fielding of IP-based wireless communications links from TMC to traffic signals in field for approximately 20 locations, cost approximately $90,000. Anticipated grant application. Estimated completion unknown.	S
Irvine Traffic Control System Upgrade	ATMS 3: Surface Street Control	City of Irvine	Conversion of VMS to ACTRA central control system and 2070 controllers. Rehab fiber optics backbone, expand CCTV system, expand Emergency Vehicle Pre-emption system, and participate in multi-modal transportation systems.	S
Caltrans District 12 &D8 ATMS Upgrade	ATMS 3: Surface Street Control ATMS 4: Freeway Control	Caltrans	Upgrade ATMS in Caltrans D8 & District 12 to include the full ATMS functions, and incident detection and event management capabilities to improve response times and operation.	S/M

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
Upgrade Fiber Optics & Install CMS	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Include a series of project within Orange County on CCTV interoperability, improving and upgrading ramp meters at different locations over the next 9 years.	S/M
Ramp Metering Facility Upgrade	ATMS 4: Freeway Control	Caltrans	Complete URMS software development. Upgrade ramp meter controllers to type 2070. Upgrade vehicle detection equipment and software. Install new vehicle detection stations to identify bottlenecks. Construct additional storage on the on-ramps to facilitate system wide adaptive ramp metering	S/M
Traffic Signal Systems Upgrade	ATMS 3: Surface Street Control	Cities	Upgrade cities' traffic signal systems to be more reliable and easier to maintain, improve signal synchronization, and possibly add adaptive signal control. Improve signal coordination across boundaries between jurisdictions.	S/M
Traffic Detection/monitoring System Upgrade	ATMS 1: Network Surveillance ATMS 3: Surface Street Control	Cities Caltrans	CCTV and video detection/joint use with traffic and security, add new TMC equipment.	S/M

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
Improve Fiber Optic Communication	ATMS 1: Network Surveillance ATMS 3: Surface Street Control	Cities Caltrans	Integrate and share fiber optic network.	S/M
SR-91 Express Lane TOC	ATMS 4: Freeway Control	OCTA Caltrans	Upgrade features incident management software and CMS, CCTV, and VDS and new TOC hardware. CCTV and Loop detection control and information is to be shared with Caltrans.	S
SR-91 Congestion Detection	ATMS 1: Network Surveillance	OCTA Caltrans	A system monitoring average travel time and congestion as an input to dynamic pricing scheme for the SR-91 Express Lane. Possible detection devices include enhanced group loops, microwave, infrared, RFID, and cell probe.	M/L
GIS Integration	ATMS 07: Regional Traffic Control	Cities County Caltrans OCTA CHP	Integrate the Geographic Information Systems used by all agencies for more accurate communication and data sharing.	L
Paratransit IVR System	APTS 3: Demand Response Transit Operation	OCTA	An Interactive voice response system will provide ACCESS clients the ability to manage their trips via a touch-tone phone. In future, it will provide client call-out features with trip confirmation and real time pickup estimates.	S

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
Coordinated Incident Management	EM 1: Emergency Call-Taking and Dispatch EM 2: Emergency Routing	Cities Caltrans CHP	Coordinate incident response among emergency agencies and TMCs of the Cities and Caltrans.	M
Technical Staff Training	MC 10: Maintenance and Construction Activity Coordination	Cities OCTA Caltrans Private Tech Service Providers	Cooperation and sharing in signal technicians training, infrastructure maintenance, and latest technology implementation.	M/L
CCTV Integration	ATMS 1: Network Surveillance	Cities Caltrans	Multi-jurisdictional system linking camera systems.	M
SR-91 Multimodal Trip Planning	ATIS 4: Dynamic Route Guidance	OCTA RCTC	Multimodal trip planning system for SR-91 between Orange County and Riverside County. It would incorporate alternatives including SR-91 Express Lanes, SR-91 Free Lanes, MetroLink, and Express Bus services.	S
Placentia SSM Rail/Highway Crossing Safety Improvement	ATMS 14: Advanced Railroad Grade Crossing	Cities of Placentia OCTA, Rail Service Providers	Grade-separate crossings. Coordinate highway signal and traffic signal control with rail service to create a Quiet Zone, minimize delay, and improve safety level.	S/M

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
Ortega Surveillance and Coordination Improvements	ATMS 3: Surface Street Control	San Juan Capistrano	Surveillance and Coordination systems improvements on Ortega Hwy from east City limits to I-5.	S
Carbon Canyon Road Capacity Enhancement Project	ATMS 3: Surface Street Control ATMS 6: Traffic Information Dissemination ATMS 8: Traffic Incident Management System ATMS 18: Reversible Lane Management	City of Brea Caltrans Orange County Chino Hills	The project components involve improving Carbon Canyon Road (S.R.-142) through traffic management and use of reversible lane infrastructure/technology to increase roadway capacity during peak hours; and the use of fiber optic communication system and ITS technology for lane control, Dynamic Message Signs, CCTV and Incident Management Systems to enhance traffic flow on this rural highway.	L
Brea Mall & Downtown Parking Management	ATMS 16: Parking Facility Management	City of Brea	Parking surveillance, coordination and management and interface with motorists via the use of Dynamic Message Signs for the Brea Mall and Brea Downtown areas	L

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
Fullerton Transportation Center & Downtown Parking Management	ATMS 16: Parking Facility Management	City of Fullerton	Parking surveillance, coordination and management and interface with motorists via the use of Dynamic Message Signs for the Fullerton Transportation Center, Fullerton Downtown and area colleges and universities.	L
S.R.-57 Freeway Incident Management System & Alternate Routes	ATMS 4: Freeway Control ATMS 6: Traffic Information Dissemination ATMS 8: Traffic Incident Management System	Cities of Anaheim, Brea, Fullerton and Placentia Caltrans	The project components involve the use of ITS technologies, such as fiber optic communication system, Dynamic Message Signs, CCTV etc., to implement incident detection and management on S.R-57 freeway and route traffic during incidents to freeway alternate routes such as State College Boulevard and Kraemer Boulevard.	L

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
S.R.-91 Freeway Incident Management System & Alternate Routes	ATMS 4: Freeway Control ATMS 6: Traffic Information Dissemination ATMS 8: Traffic Incident Management System	Cities of Anaheim, Buena Park, Fullerton, La Palma and Placentia Caltrans	The project components involve the use of ITS technologies, such as fiber optic communication system, Dynamic Message Signs, CCTV etc., to implement incident detection and management on S.R-91 freeway and route traffic during incidents to freeway alternate routes such as Orangethorpe Avenue and La Palma Avenue.	L
In Orange County - upgrade ramp meters	ATMS 3: Surface Street Control ATMS 4: Freeway Control	Caltrans	Upgrade ramp meters in various location throughout Orange County	M
In Irvine and Mission Viejo - install fiber optic and hub station	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Install fiber optic and hub station on Toll Road 241, 261 and 133 to complete the communication system between exsiting field elements and Caltrans TMC	M/L

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
Route 5 - Upgrade fiber optics and replace CCTVs from SR-133 to Rte 55	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Upgrade fiber optics to increase the capacity for Caltrans communication system and local agencies use because this is the vital link to connect fibers and field elements from SR-55, I-5, Sr-91 and Sr-57 to the TMC. CCTVs need to replace with fiber communications	M/L
Route 55 - Upgrade Fiber Optics From I-405 to I-5	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Upgrade fiber optics to increase the capacity for Caltrans communication system and local agencies use because this is the vital link to connect fibers and field elements from SR-55, I-5, Sr-91 and Sr-57 to the TMC. CCTVs need to replace with fiber communications	M/L
On Route 5 - Install CMS	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	On I-5, SR-55, SR-57, I-405, and SR-133	S
Route 405 from I-5 to SR-55 in the City of Irvine - Upgrade Fiber Optics	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Upgrade fiber optics to increase the capacity for Caltrans communication system and local agencies use because this is the vital link to connect fibers and field elements from SR-55, Sr-91, I-405 and Sr-22 to the TMC. CCTVs need to replace with fiber communications	M/L

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
Route 405 from SR-55 to Euclid in the City of Costa Mesa - Install Fiber Optics and CCTV	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Install fiber optics and CCTV and information to be shared with local agencies	M/L
SR-73 - Install CMS	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Install CMS @ PM 15.6, 16.6, R26.9, SR-74 @ PM 0.0, SR-91 @ PM R0.0, R14.4, SR-241 @ PM 18.3, 21.5, I-405 @ PM 16.5, and I-605 @ PM R1.6 for traffic incident management, Amber Alert and information is to be shared between local agencies.	S/M
Caltrans TMC - Inertie Upgrade	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Enhancing and improving Caltrans existing fiber link and equipments to enable CCTV operability with local agencies	M/L
Caltrans TMC - ATMS	ATMS 1: Network Surveillance	Caltrans	Develop Alternate Route Plans on Electronic Thomas Bros. Map of ATMS system.	S
Caltrans TMC - video servers	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Deploy Video servers and supporting applications for CCTV video streaming on the Internet and information is to be shared with local agencies.	S

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
Caltrans TMC - Traveler Information System	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	A system monitoring travel time and congestion on the freeway	M/L
Route 405 from 22 to LA County Line - Install Fiber Optics and CCTVs	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Install fiber optics and CCTV and information to be shared with local agencies	M/L
SR-91 from LA County Line to I-5 - Install fiber optics and CCTV	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Install fiber optics and CCTV and information to be shared with local agencies	M/L
Caltrans TMC - upgrade CMS Software	ATMS 1: Network Surveillance	Caltrans	Upgrade CMS software to operate with Window application instead of using DOS application	M/L
Route 605 - from 405 to LA County Line - Install fiber optics and CCTVs	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Install fiber optics and CCTV to communicate and data sharing with LA county and local agencies	M/L

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
Rte 55 - From PCH to Wilson St.	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Install fiber optics and CCTV and information to be shared with local agencies	M/L
SR-133 from SR-1 to I-5 in Laguna Beach - Install fiber optics and CCTVs	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Install fiber optics and CCTV and information to be shared with local agencies	M/L
Rte 73 - From Jamboree to I-405 - Install Fiber optics and CCTVs	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Install fiber optics and CCTV and information to be shared with local agencies	M/L
SR-73 - from PM 5.0 -R18.0 - 170 Controllers replacement	ATMS 3: Surface Street Control ATMS 4: Freeway Control	Caltrans	Pilot Replacement of 170 Controllers with 2070 Controllers	M
Caltrans TMC - ATM network	ATMS 1: Network Surveillance	Caltrans	Install ATM Network with redundancy, interconnect all district hubs, install network management systems.	L

Project Title	Market Package(s)	Stakeholder(s)	Description	Timing*
Traffic Signal Systems Upgrade	ATMS 3: Surface Street Control ATMS 4: Freeway Control	Caltrans	Link traffic signals (at freeway ramps) to TMC through fiber optics and telephone lines	M
Rte 5 - From San Diego County Line to Rte 73 - Upgrade fiber Optics and CCTVs	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Upgrade Fiber Optics and CCTV	M/L
State Routes - Install fiber optics and CCTVs	ATMS 1: Network Surveillance ATMS 4: Freeway Control	Caltrans	Install fiber optics and CCTVs and information to be shared with local agencies	M/L
Caltrans TMC	ATMS 1: Network Surveillance	Caltrans	ATMS system software upgrade	M

**Note: Timing, S—Short Term; M—Medium Term; L—Long Term*

10 IDENTIFICATION OF DESIRED STANDARDS

The standards chapter of a Regional ITS Architecture is a section required by "The Policy/Rule." It requires the identification of applicable ITS standards that support regional and national interoperability. It does not mandate their use. In California, this requirement is reinforced by legislation AB3418. AB3418 passed in 1995 is a Caltrans communications standard that ensures interconnectivity of traffic signal control devices, and does so by utilizing existing communication standards and models. AB3418 specifies parts of the NTCIP and ISO/IE specifications for the data link layer but specifies a fixed set of messages related to traffic signal controllers.

This section has two major objectives: (1) to identify ITS standards that support the interfaces and flows defined in the architecture and (2) to help Stakeholders understand more about standards and their potential value and benefits. Many Stakeholders in Orange County have expressed interests in open architecture and National Transportation Communications for ITS Protocol (NTCIP) standards. Dialog on the standards of ITS for OC ITS projects should be pursued in workshops and forums. With this said, standards and their development is far from a simple subject and both the full development and testing of standards and their effective adoption by vendors is in many cases still some way off in the future.

For the Southern California Regional ITS Architecture there is a Multi-County issues document that also deals with standards and addresses the need for region-wide standards for the exchange of center-to-center information. A project to develop a data dictionary has been identified but not yet developed. This means that it is premature for Orange County to seek to build consensus and agreement at this point on adopting center-to-center countywide standards to include in their Orange County Regional ITS Architecture. It is however appropriate to begin the process of education and understanding of standards and their benefits and the manner in which certain standards are becoming closer to full adoption. Open architecture associated with signal systems and other field devices has been identified as a matter of importance for Orange County. This will likely become a subject of further discussion amongst stakeholders as procurement of these systems continues. One topic of discussion worthy of consideration would be joint procurements of systems and their maintenance. Such an approach might lead to larger procurements that would place increased pressure on vendors to lower prices and respond to the need for genuinely open architecture.

In this chapter, ITS standards are identified for each information flow in the Orange County ITS architecture. Establishing regional and national standards for exchanging information among ITS systems is important not only from an interoperability point of view. Moreover, standards facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances and new approaches evolve. It also reduces risk and cost since a region can select among multiple vendors for deployment products. Standards help create competition, better

products, and lower prices. The ITS community recognized these advantages and therefore encouraged Standards Development Organizations (SDOs) to create ITS standards between the most critical ITS system interfaces.

There are currently 89 ITS standards of five different types, namely communication standards, data standards, message set standards, equipment standards, and software standards. The regional ITS architecture is only required to reference those standards that are applicable to the region and this is done by relating the identified information flows to relevant standards. The full report is an output from the TurboArchitecture™ software and is attached as Appendix E.

10.1 Standards Development Organization

The ITS community recognized the advantages of standards and encouraged SDOs to create ITS standards between the most critical ITS interfaces. The following is a list of SDOs that are developing ITS standards. The overall responsibility for the ITS standards development program rests with the US DOT, ITS Joint Program Office. The following paragraphs describe the various SDOs that are currently involved in some aspect of ITS standards development. Each of the underlined headings is a link to that organization's web site where further background information and details can be found.

American Association of State Highway and Transportation Officials (AASHTO): AASHTO, teamed with the National Electrical Manufacturers Association (NEMA) and the Institute of Transportation Engineers (ITE), is the lead organization for the National Transportation Communications for ITS Protocol (NTCIP). (Also see the NTCIP SDO description below.)

American National Standards Institute (ANSI): The American National Standards Institute (ANSI), the U.S. administrator and coordinator of private sector voluntary standardization, does not itself develop standards. An ANSI committee [the Accredited Standards Committee (ASC) X12] was chartered to develop standards to facilitate electronic data interchange (EDI) for business transactions. This committee is in the process of developing ITS-related standards involving commercial vehicle operations (CVO).

American Society for Testing & Materials (ASTM): ASTM provides a forum for producers, users, consumers, and others who have interest in standard test methods, specifications, practices, guides, classifications, and terminology. ASTM leads efforts in ITS standards concerning dedicated short-range communications (DSRC).

Commercial Vehicle Information Systems Network (CVISN – US DOT sponsored program): The scope of commercial vehicle operations, of which CVISN is a part, includes the operations and regulations associated with moving goods and passengers via commercial vehicles. It includes activities related to safety assurance, commercial vehicle credentials and tax administration, roadside operations, freight and fleet management, and vehicle operation.

Consumer Electronics Manufacturers Association (CEMA): CEMA is a sector of the Electronic Industries Alliance (EIA). Two ITS standards have been developed under the auspices of CEMA, both having to do with traveler information radio and FM sub carrier systems.

Data Interchange Standards Association (DISA): DISA was chartered by the American National Standards Institute (ANSI) to provide its Accredited Standards Committee (ASC) X12 with administrative support. Some commercial vehicle operations (CVO) related standards are available for purchase at this site.

Institute of Electrical and Electronics Engineers (IEEE): The IEEE develops and disseminates voluntary, consensus-based industry standards involving all types of electro technology. ITS-related standards being developed by IEEE include message sets and data dictionaries.

Institute of Transportation Engineers (ITE): The Institute of Transportation Engineers (ITE) is one of the largest professional transportation organizations in the world. ITE members include traffic engineers, transportation planners, and other professionals who are responsible for planning, designing, implementing, operating, and maintaining surface transportation systems worldwide. ITE is involved in the development of NTCIP, TCIP, and other ITS standards.

ITS America (ITSA): The Intelligent Transportation Society of America fosters public/private partnerships to increase the safety and efficiency of surface transportation through the application of advanced technologies. This site contains many excellent resources for basic information on ITS and related topics.

National Electrical Manufacturers Association (NEMA): NEMA is one of the largest standards development organizations (SDOs) in the nation and represents over 600 member organizations. NEMA is a member organization of NTCIP and acts as the publisher of NTCIP standards.

National Transportation Communications for ITS Protocol (NTCIP): The primary objective of the NTCIP is to provide communication standards that ensure the interoperability and interchangeability of traffic control and intelligent transportation systems (ITS) devices. The NTCIP is the first protocol for the transportation industry that provides a communications interface between disparate hardware and software products.

Oak Ridge National Laboratory (ORNL): Oak Ridge National Laboratory's Intelligent Transportation Systems (ITS) Research Program provides technical assistance and program support to the FHWA in the following subject areas: traffic simulation, signal optimization, real-time control, human factors, automation and systems engineering, operations research, traffic models, and management information systems.

Security Industry Association (SIA): The SIA was formed in 1969 to promote growth and expansion in the access control, auto security, biometrics, burglar alarm, CCTV, lock

hardware, monitoring, outdoor protection, perimeter protection, personal response systems, and personal security product industries. SIA has recently begun to investigate the need for ITS-related standards.

Society of Automotive Engineers (SAE): This organization is made up of more than 75,000 engineers, business executives, educators, and students who share information and exchange ideas for advancing the engineering of mobility systems. Information about SAE's ITS standards activities can be found within the "Technical Committee" section of this Web site. SAE has developed several ITS standards related to in-vehicle electronics architectures and advanced traveler information systems.

Telecommunications Industry Association (TIA): TIA is a national trade organization that provides communications and information technology products, materials, systems, distribution services and professional services. The association's member companies manufacture or supply most of the products used in global communication networks.

Transit Communications Interface Profiles (TCIP): The TCIP is a family of ITS standards for transit communications. These new standards provide the interfaces among transit applications that will allow data to be shared by transit departments and other operating entities such as emergency response services and regional traffic management centers.

Transit Standards Consortium (TSC): The Transit Standards Consortium is a public/private, non-profit organization that facilitates the development, testing, maintenance, education, and training related to transit standards. The organization includes transit agencies, standards bodies, vendors, and other interested parties.

Volpe National Transportation Systems Center: The John A. Volpe National Transportation Systems Center (Volpe Center), located in Cambridge, MA, is an organization of the Federal Government whose principal role is to serve as a national center of transportation and logistics expertise. As such, it provides research, analytic, management, and engineering support to the U.S. Department of Transportation, other Federal agencies, and state and local governments.

10.2 Standards Elements

A number of key elements make up a standard or set of standards. These include Data Dictionaries, Message Sets, Object Definitions, and Communications Protocol. Each of these is described in more detail below.

10.2.1 Data Dictionary

Data Dictionaries provide the definition and format of individual data elements that are then grouped into individual messages. In other words, messages are the sentences and data elements are the individual words.

Two good examples of data dictionaries are the Traffic Management Data Dictionary (TMDD) developed by the Institute of Transportation Engineers (ITE) and the Advanced Traveler Information Systems (ATIS) Data Dictionary developed by SAE.

10.2.2 Message Set

Message Sets (MS) are an essential component in the design and operation of modern computer based systems. They provide the basic information flows (generally described as messages) upon which communications between systems depend. Specifically, a message set provides the information definition (semantics) and format (syntax) to handle individual informational exchanges on specific topics. Thus, agreed upon message sets with unambiguous message definitions is one of the essential characteristics of standards required for information exchange between individual traffic management systems. Message sets are also important for communications between traffic management systems and other ITS users and/or suppliers of traffic related information. An example of a currently implemented Message Set is Location Reference Message Specification (LRMS). This specification standard was developed at Oak Ridge National Laboratory. The LRMS establishes standard formats for individual messages used within message sets to convey locations. The design of the LRMS is based on three fundamental concepts. First, the transfer of a location is a message in itself. Second, the use of multiple location message options (termed profiles) is used within an expandable framework. Finally, the use of a set of well-known ground control points (referred to as “datums”) is used to permit registration of different map databases to one another so that locations transferred can be understood with minimal ambiguity. Message Sets work hand-in-hand with Data Dictionaries and Communications Protocol.

10.2.3 Object Definitions

The analogy to message sets in the world of object oriented software is object definitions. Objects are intuitive in nature – for example bus objects, traffic signal objects, vehicle detector objects, incident objects, etc. Each defined object has attributes or characteristics and methods that act upon it. For example, a bus object contains attributes of <driver ID>, <bus number>, <passenger capacity>, <wheelchair compatible>, and so on. A bus object can be created, removed, or stored – these are examples of its methods.

10.2.4 Communications Protocols

The communications interface standards provide guidance on the first four layers of the Open System Interconnect (OSI) reference model. The data dictionary, message set, and object definitions deal with the fifth through seventh layers of the OSI reference model. The applicable NTCIP communication interface standards describe communications at the physical, link, network, and transport layers of the model. The communications standards address items such as electrical levels, cabling, connectors, how fast data can be exchanged, contention management, error detection and resolution, as well as addressing. Defined standards accommodate different layers (or groups of layers) of the protocols. For example, many installations utilize NTCIP 2202 (Internet (TCP/IP and UDP/IP) Transport Profile for layers three and four. NTCIP 2104 (Ethernet Sub-network Profile) defines requirements for layers one and two including

requirements for specific types of coaxial cable, twisted wire pairs, and fiber-optic media.

10.3 ITS Standards Identification Process

In general, each information flow has up to three types of standards that are relevant: a message set standard, a data element standard, and one or more communications protocol standards. Especially in the area of communications protocols, there are various technology choices that a region can make. Making the best choices depends on multiple factors, including throughput (how much data must be transmitted or received on the interface), network topology (how the ITS systems are connected together), and infrastructure (fiber optic lines, leased land lines, etc.). In most cases the final technology choices are up to the communications experts during project implementation. Typically, these decisions are made as part of the Plans, Specifications and Estimates (PS&E) for each project.

By evaluating each standard with the above questions, the levels of maturity or stages of development for standards include:

- Has the ITS standard been approved or published by the SDOs?
- Has the ITS standard been adopted by multiple vendors?
- Has the ITS standard been tested, whether informally by the vendor, or through the formal ITS Standard Testing Program funded by FHWA?
- Is there an amendment to the ITS standard currently in the works, and if so, how much of the standard will change as a result?

By evaluating each standard with the above criteria, the levels of maturity or stages of development for standards include:

- Draft Under Development. During this phase, there are significant changes likely to occur. 19 standards are in this category.
- Draft for Ballot or in Balloting. Standards being voted upon by a committee or working group or are undergoing other SDO procedures. 10 standards are in this category.
- Approved. Standards that have passed all necessary ballots and have been approved by an SDO, but have not been published yet. 4 standards are in this category.
- Published. Standards available for purchase and use. 56 standards are in this category.
- Tested/deployed Standards. Only minor changes are likely to occur in this phase of a standard development.

The current maturity status of standards can be obtained from www.standards.its.dot.gov/standards.htm

10.4 ITS Standards for Orange County

The ITS Standards report would include all selected Standards for each information flow in the region. TurboArchitecture™ provides an ITS Standards Report based on all of the architecture flows selected in the region. The report in Appendix E lists all standards associated with each architecture flow.

In addition to the interface standards that are being defined for ITS, a range of other regional standards may be considered that would facilitate interoperability and implementation of the regional ITS architecture. For example, standard base maps, naming conventions, measurement & location standards, and organizational structure identifiers can all facilitate the meaningful exchange of information between systems in the region.

Orange County is not of course an island. Some projects under development in Orange County involve exchange of data with agencies in other Southern California counties. The Multi-County Issues documentation of the Southern California Regional ITS Architecture discusses this in the context of the development of a data dictionary for data exchange across the region.

11 Maintaining the ITS Architecture

At the end of this exercise to develop the Regional ITS Architecture for Orange County a point has been reached when it is time to consider the future support activities needed to insure that the architecture is used, that projects are funded and deployed and the architecture documentation is updated as needed. The six SCAG counties are at very different stages of ITS development and their stakeholders reflect different areas of focus. It is therefore understandable that such differences will also be reflected in some alternative approaches to maintenance of their architectures. Counties that already have regional networks established such as Los Angeles County have an architecture maintenance structure that reflects a focus on a formal configuration management process. The Regional ITS Architecture document is treated as one of the many documents that must be maintained by the configuration management administration.

Each county is adopting an architecture maintenance process that best reflects its needs. Orange County currently has only limited interconnected systems. In the future, it is likely that many more systems will become interconnected which will create new opportunities for the development of a possible regional network. This will require continuous dialogue between the specific partnerships but support for wider discussion of county needs and the progression toward more integrated systems can also be pursued through a variety of initiatives.

Previously, Orange County had a group that met regularly composed mainly of traffic engineers from the cities, the County and Caltrans. At a later stage an ITS group was developed and met regularly to help oversee “Showcase” funded projects. Neither group exists today following completion of the Orange County TravelTIP and Transit Probe demonstration projects. Most recently Caltrans has taken the lead in developing a forum for Caltrans and the cities to discuss matters of mutual interest. The Orange County regional ITS Architecture effort has built off this effort and has now established a broadly based stakeholder group that reflects the interests of all agencies including the emergency services.

11.1 Responsibility for Architecture Maintenance

The Orange County Regional ITS Architecture stakeholder group undertakes to support the continued maintenance of the architecture effort through the pursuit of dialogue opportunities such as forums or meetings and multi-agency project involvement. Shared coordination responsibilities between agencies are envisaged. Caltrans District 12 will continue to coordinate bi-monthly stakeholder meetings. OCTA will lead efforts to maintain the architecture documentation as needed and transmit changes to SCAG to meet RTIP update requirements which will be included in the Southern California Regional ITS Architecture Maintenance Plan.

11.2 Identification of Maintenance Items

There are several different parts and reports that make up the Orange County regional ITS Architecture. Some will require more frequent updates than others and the entire

document will need a periodic review for consistency with regional vision and goals as they continue to mature. For the most part, it is anticipated that this baseline document will require little major review for the first five years. SCAG will request updates to the list of projects for inclusion in the tri-annual Regional Transportation Improvement Program (RTIP). As need arises, changes to the documentation can be forwarded to SCAG for recording and filing. SCAG will develop a maintenance management plan that will include a tracking system that will firmly relate all updates to the current version of the document.

11.3 Architecture Modification Process

The process for amending the architecture is based on agreement between stakeholders as to what needs to be changed or updated. Minor changes can simply be made to the word document. Such changes might include the addition of projects to the project sequencing section within the existing list of market packages. If significant new initiatives arise that involve the addition of new market packages and their associated operational concept and functional requirements these changes can be made by agency staff or the services of a consultant. In all cases, the major requirement is that changes are noted and copied to SCAG.

11.4 Frequency of Architecture Maintenance

The operational concept, system functional requirements and the list of agency agreements represent high level view of Orange County Regional ITS Architecture and do not necessarily need to be modified each time a minor revision is made to the architecture. As major projects with multiple partners are developed and deployed it can be expected that they will necessitate their own project architecture and follow system engineering principles that involve detailed functional and system requirements analysis tracing all necessary interconnects and flows. These detailed plans are appropriate to the project architecture not the high level regional documentation. Following deployment of such new systems high-level modifications to the regional architecture documents may be required. Significant modifications to the document are not expected to occur more frequently than every 3-5 years.

11.5 Change Management Process

As indicated, a tracking system for regional architecture changes will be developed in the SCAG Architecture Maintenance Plan. Orange County as well as all of the other contributors to the Southern California Regional ITS Architecture will use this simple system. As Orange County ITS integrated projects become more defined configuration management of the systems will become an issue and a group of active stakeholders may be required to manage these issues which may lead to changes to the architecture documents. Such issues lie in the future for Orange County.

12 List of Agency Agreements

Agreements among the different Stakeholder agencies and organizations are required to implement the integration described in the regional ITS architecture. According to the FHWA Regional ITS Architecture Guidance, any agreements (existing or new) required for operations, including at a minimum those affecting ITS projects interoperability, utilization of ITS related standards, and the operation of the projects identified in the regional ITS architecture should be listed.

The list of the required Orange County agreements was developed based on the regional operational concepts, knowledge of the types of ITS existing or planned for implementation in the County, and the information that needs to be exchanged in order to operate those systems. The detailed agreement work, including the preparation and execution of the identified agreements, will be performed to support ITS projects as they are implemented in the future.

There is considerable variation between ITS projects and among Stakeholders regarding the types of agreements that are created to support ITS integration. Some common types of agreements provided by the Regional ITS Architecture Guidance are shown in Table 12-1.

Table 12-1: Agreement Types

Type of Agreement	Description
Handshake Agreement	▪ Early agreement between one or more partners ▪ Not recommended for long-term operations.
Memorandum of Understanding (MOU)	▪ Initial agreement used to provide minimal detail and usually demonstrating a general consensus. ▪ Used to expand a more detailed agreement like an Interagency Agreement that may be broad in scope but contains all of the standard contract clauses required by a specific agency. ▪ May serve as a means to modify a much broader Master Funding Agreement, allowing the master agreement to cover various ITS projects throughout the region and the MOUs to specify the scope and differences between the projects.
Interagency Agreement	▪ Between public agencies (e.g., transit authorities, cities, counties, etc.) for operations, services or funding. ▪ Documents responsibility, functions and liability at a minimum.

Type of Agreement	Description
Intergovernmental Agreement	▪ Between governmental agencies (e.g., Agreements between universities and State DOT, MPOs, etc.).
Operational Agreement	▪ Between any agency involved in funding, operating, maintaining or using the right-of-way of another public or private agency. ▪ Identifies respective responsibilities for all activities associated with shared systems being operated and/or maintained.
Funding Agreement	▪ Documents the funding arrangements for ITS projects (and other projects). ▪ Includes at a minimum standard funding clauses, detailed scope, services to be performed, detailed project budgets, etc.
Master Agreements	▪ Standard contract and/or legal verbiage for a specific agency and serving as a master agreement by which all business is done. These agreements can be found in the legal department of many public agencies. ▪ Allows states, cities, transit agencies, and other public agencies that do business with the same agencies on a regular basis (e.g., cities and counties) to have one Master Agreement that uses smaller agreements (e.g., MOUs, Scope-of-Work and Budget Modifications, Funding Agreements, Project Agreements, etc.) to modify or expand the boundaries of the larger agreement to include more specific language.

The agreement should describe the high-level information that each agency needs to exchange in order to meet each others' goals and expectations rather than defining how the delivery of that information will occur. The agreements should avoid being excessively technology prescriptive since technology changes rapidly.

The process may begin with something as simple as a handshake agreement. But, once interconnections and integration of systems begin, agencies may want to have something more substantial in place. A documented agreement will aid agencies in planning their operational costs, understanding their respective roles and responsibilities, and build trust for future projects. Formal agreements are necessary where funding or financial arrangements are defined or participation in large regionally significant projects is required. Catalysts for agreement development are usually projects involving any of the following: data sharing, any aspects of shared

control/interoperability, ownership and maintenance of equipment, shared communications (e.g. fiber), operations (e.g. 24/7 or peak period only), liability issues, configuration management of jointly owned and operated systems, ownership of data and third party agreements.

Table 12-2 presents the list of agreements for Orange County, including both existing and planned agreements. Each entry identifies the ITS service addressed by the agreement, the Stakeholders involved, the type of agreement anticipated, high-level status (near-term or long-term), and a concise description of the purpose of the agreement. Another column can be added to the table in the future to note any issues or barriers in agreement execution during the architecture maintenance cycle.

Table 12-2: Orange County List of Agreements

ITS Service	Stakeholder	Type of Agreement	Status	Agreement Description
Rail/Highway Crossing Management	Caltrans, OCTA, Cities, and Rail Service Providers	Interagency Agreement	Near Term	Specifies roles, responsibilities, and functions for rail grade crossing coordination and optimization at signaled intersections
Inter-jurisdictional Traffic Management	Caltrans District 12 and other adjacent Caltrans districts and CHP	Interagency Agreement	Near Term	Provides for data exchange, device control, detailed jurisdiction-to-jurisdiction operations, and regional incident management
Regional Traffic Management and Emergency Services	Caltrans and cities, County, and EMS providers	MOU	Near Term	Provides for signal operations and coordination and local incident management
Emergency Vehicles Signal Preemption	Caltrans, Cities, County, and EMS providers	Interagency Agreement/or MOU	Long Term	Specifies the roles, responsibilities, and functions for emergency vehicle preemption at signalized intersections for police, fire, ambulance, and other agencies

ITS Service	Stakeholder	Type of Agreement	Status	Agreement Description
Transit Signal Priority	Caltrans, Cities, County, and OCTA	Interagency Agreement/MOU	Long Term	Specifies the roles, responsibilities, and functions for transit vehicle priority at signalized intersections for transit agency
Emergency Call Answering and Freeway Service Patrol	Caltrans, CHP, and OCTA	Interagency Agreement	Near Term	Specifies the roles, responsibilities, and functions for providing a call answering service and freeway service patrol activities
Traveler Information	All Transportation Agencies in the County and ISPs	MOU/Service agreements with ISPs	Long Term	Specifies expectations, roles, and responsibilities for the provision of transportation-related data and information to the traveling public. Also documents the policy or disclaimer for release of traveler information
Archived Data Management	All Transportation Agencies	MOU/Service agreements with users	Long Term	Specifies expectations, roles, and responsibilities for the provision of transportation-related data and information to a public archive agency, recognition of sources
Infrastructure, Device, and Data Sharing	Caltrans, OCTA, and Cities	Interagency Agreement/MOU	Near Term	Documents provisions for design, development, maintenance, and revenue sharing (if applicable) with regards to shared use of fiber.